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ABSTRACT

This report documents and evaluates the activities of the Urban Mathematics Collaborative (UMC) project during the 1989-90 school year. UMC seeks to improve mathematics education in inner-city schools and identify new models for the professional development of mathematics teachers by supporting collaboration among mathematics teachers and mathematicians from institutions of higher learning and industry. Teachers are encouraged to identify with and participate in a broad-based local mathematics community. The project is currently operating in 11 cities across the country. A variety of qualitative and quantitative methods were used to evaluate the project. The following summary findings are presented: (1) the project has been successful in reducing teacher isolation, increasing professional enthusiasm, and enhancing teacher awareness of and receptivity to new ideas; (2) the project has not been successful in developing teacher evaluation and critical reflection skills; (3) the project has increased the awareness of businesspeople and educators about teacher commitment and enthusiasm, but communication problems prevent an appreciation of the daily problems faced by teachers; and (4) the project has made school district administrators more aware of mathematics teachers and mathematics education and increased interaction between district supervisors and teachers. Descriptions of the 11 UMC collaboratives are included. A list of 36 references and summary reports from the 11 collaboratives are appended. (FMW)

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April 1991

Program Report 91-1

# The Urban Mathematics Collaborative Project: Report to The Ford Foundation on the 1989-1990 School Year

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Marilyn Sapienza, Thomas A. Romberg,
Allan J. Pitman, and James A. Middleton

Report from
the Urban Mathematics Collaborative (UMC) Documentation Project

UD 028 111

**Wisconsin Center for Education Research**
**School of Education, University of Wisconsin–Madison**

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Program Report 91-1

# THE URBAN MATHEMATICS COLLABORATIVE PROJECT: REPORT TO THE FORD FOUNDATION ON THE 1989-90 SCHOOL YEAR

Norman L. Webb, Susan D. Pittelman, Marilyn Sapienza,
Thomas A. Romberg, Allan J. Pitman, and James A. Middleton

Report from
the Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
University of Wisconsin
Madison, Wisconsin

April 1991

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# I. INTRODUCTION

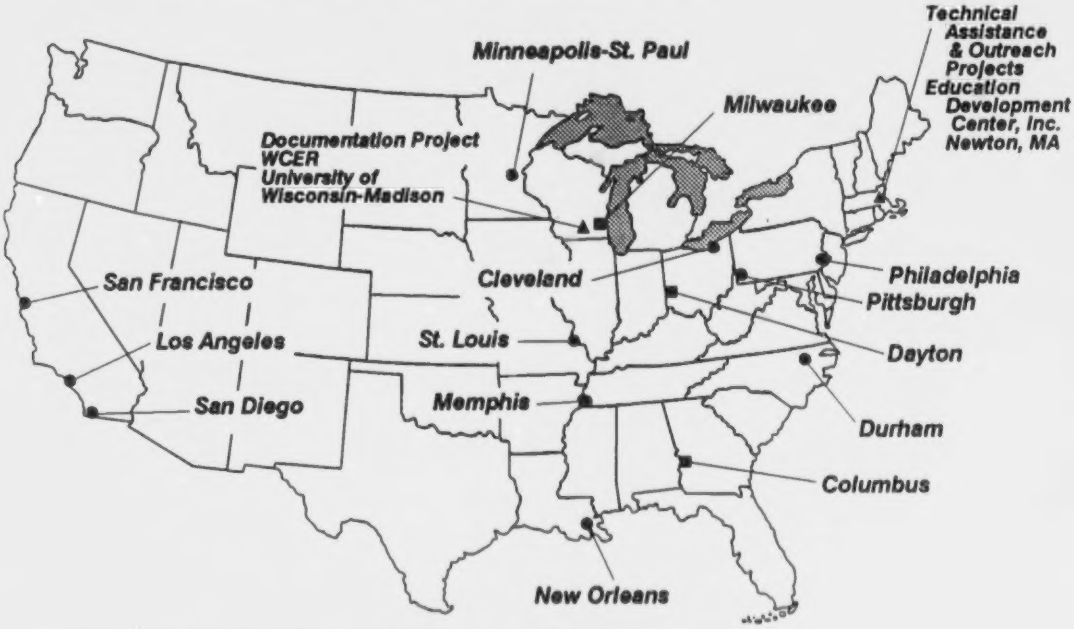
In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to improve mathematics education in inner-city schools and to identify new models for meeting the ongoing professional needs of teachers. In February, 1985, the Foundation awarded five grants to establish urban mathematics collaboratives in Cleveland, Minneapolis-St. Paul, Los Angeles, Philadelphia, and San Francisco. In addition, it established a Documentation Project to monitor the activities of the new collaboratives and a Technical Assistance Project (TAP) to serve as a source of information for the collaborative projects (Romberg & Pitman, 1985). During the next 18 months, UMC projects were funded in Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans, bringing to eleven the total number of urban mathematics collaboratives (Webb, Pittelman, Romberg, Pitman, Fadell, & Middleton, 1989; also see Annual Reports to the Ford Foundation for 1986, Romberg, Webb, Pitman, & Pittelman, 1986; for 1986-87, Webb, Pittelman, Romberg, Pitman, & Williams, 1988; and for 1988-89, Webb, Pittelman, Romberg, Pitman, Middleton, Fadell, & Sapienza, 1990). In August, 1987, an Outreach Project was funded to publicize and expand the UMC effort. In August of 1989, the Ford Foundation awarded replication grants to support activities in three additional sites interested in starting mathematics collaboratives. The three sites that received the grants were Dayton, Ohio; Columbus, Georgia; and Milwaukee, Wisconsin. A map indicating the location of UMC projects appears in Figure 1.

At each site, the UMC project supports collaboration among mathematics teachers and between teachers and mathematicians from institutions of higher education and industry; each collaborative also encourages teacher membership and participation in a broad-based local mathematics community. Since the project's inception in 1984, its guiding principle has been that the teacher is and will remain the hub of the educational process. But it also has become evident during the course of the project that many teachers--and especially those in inner-city schools--are overworked, lacking in support and material resources, and isolated from their colleagues, from other professionals, and from the rapidly changing field of mathematics.

The UMC project remains rooted in the premise that collegiality among professional mathematicians can reduce teachers' sense of isolation, foster their professional

# The
# Urban Mathematics Collaborative Project

*Funded by The Ford Foundation*


Minneapolis-St. Paul
Milwaukee
Technical Assistance & Outreach Projects Education Development Center, Inc. Newton, MA
Documentation Project WCER University of Wisconsin-Madison
San Francisco
Los Angeles
San Diego
Cleveland
St. Louis
Memphis
Philadelphia
Pittsburgh
Dayton
Durham
Columbus
New Orleans

- **Cleveland Collaborative for Mathematics Education (C$^2$ME)**
  Cleveland, Ohio
- **Durham Collaborative: The Durham Mathematics Council**
  Durham, North Carolina
- **Los Angeles Urban Mathematics/Science/Technology Collaborative (LAUM/S/TC)**
  Los Angeles, California
- **Memphis Urban Mathematics Collaborative**
  Memphis, Tennessee
- **New Orleans Mathematics Collaborative (NOMC)**
  New Orleans, Louisiana
- **Philadelphia Math Science Collaborative**
  Philadelphia, Pennsylvania
- **Pittsburgh Mathematics Collaborative**
  Pittsburg, Pennsylvania
- **St. Louis Urban Mathematics Collaborative**
  St. Louis, Missouri
- **San Diego Urban Mathematics Collaborative**
  San Diego, California
- **San Francisco Mathematics Collaborative**
  San Francisco, California
- **Twin Cities Urban Mathematics Collaborative**
  Minneapolis-St. Paul, Minnesota

### Replication Sites

- **Columbus Regional Mathematics Collaborative (CRMC)**
  Columbus, Georgia
- **Dayton-Montgomery County Public Education Fund Mathematics Collaborative**
  Dayton, Ohio
- **Milwaukee Metropolitan Mathematics Collaborative (M$^3$C)**
  Milwaukee, Wisconsin

Figure 1. The Ford Foundation National Network of Urban Mathematics Collaboratives.

enthusiasm, expose them to a vast array of new developments and trends in mathematics, and encourage innovation in classroom teaching. The Ford Foundation's commitment of human and financial resources provides a support network that encourages the development of such collegiality.

An important factor in this network is the administrative support provided by the Technical Assistance Project, the Outreach Project, the Documentation Project, and the Ford Foundation. The Technical Assistance Project was established in September, 1985, to provide a broad range of technical assistance services to the Urban Mathematics Collaborative project as a whole, as well as to each individual collaborative. Housed at the Education Development Center, Inc. (EDC), a non-profit research and development organization located in Newton, Massachusetts, the project is directed by Dr. Mark Driscoll. The project has provided each site with assistance in solving local problems and identifying local resources; provided encouragement as well as financial support for collaborative members to participate in national and regional symposia, workshops, and pilot projects; kept the sites informed of the status and direction of mathematics curriculum reform; facilitated communication and fostered networking among the collaboratives; established project priorities such as focusing on equity and on the NCTM *Curriculum and Evaluation Standards for School Mathematics* (1989); and offered guidance to each collaborative in its efforts towards permanence.

The Outreach Project was created in the fall of 1987 to complement the efforts of the collaboratives by disseminating information about the unique nature of local initiatives and by providing the collaboratives with a national voice in the arena of education policy and reform. A third responsibility of the Outreach Project is to offer assistance to other communities seeking to replicate or adopt important features of the UMC model. The Outreach Project is directed by Brian Lord and administered by EDC. During the 1988-89 school year, the Outreach Project issued a request for proposals for replication grants to support activities at sites interested in starting collaboratives based on the model of the eleven established collaboratives. By the closing date of June 15, 1989, five proposals had been received and in August, 1989, three replication grants for $8,000 were awarded.

The Documentation Project, directed by Professor Thomas A. Romberg at the Wisconsin Center for Education Research at the University of Wisconsin-Madison, was established in 1984 to record the progress of each collaborative. In December, 1987, a case study component of the project was initiated for the purpose of obtaining comprehensive feedback on collaborative impact from one or two teachers at each of the eleven original sites. Case studies were conducted at six sites during 1987-88 and at five sites during 1988-89. It should be noted that the charge to the Documentation Project did not include documenting the development of replication sites.

The efforts of the eleven original collaboratives, as well as those of the Ford Foundation, merit study based on conscientious documentation for three reasons:

(1) Each of the collaboratives, as well as the Ford Foundation, needed to be kept informed about the development of the individual projects. Ongoing collaborative strategies and activities, and the effects of these on the professional lives of teachers and other project participants, needed to be documented in order to be shared.

(2) It is important for each collaborative, the Ford Foundation, and the educational policymaking community to understand the characteristics and relationships inherent in individual collaborative projects. Because change occurs over time, all of the activities that are carried out, the actual changes in behavior, the anticipated outcomes, and the impediments encountered must be documented so that they can be clearly identified and studied.

(3) Although it was expected that each collaborative site would be different, it was believed that it would be possible to identify project activities, problems, and strategies that could be generalized across the collaboratives and applied to different settings. These generalizations have proven to be important now that other sites are beginning to establish mathematics collaboratives. Furthermore, by encouraging mathematics teachers to act as self-directed professionals, the collaboratives are generating strategies that can be used with teachers of all subjects.

In addition to collecting and synthesizing information for each collaborative, the Documentation Project provides each of the collaboratives with a broader view of its place in the overall UMC project. It serves as a source of information about how other sites are dealing with similar issues and provides advice on problems common to all sites. The staff also provides professional expertise in mathematics education when such input is requested.

In the formative years of the UMC project, Ford Foundation Program Officer Dr. Barbara Scott Nelson was a visible spokesperson for the collaboratives. She visited with key personnel at each site, representing the commitment and interest of the Foundation and assisting each project in its efforts to gain local support. She has been a mentor, mediator, and problem solver, consistently supporting the collaborative projects as they sought to realize the collaborative vision that guides the efforts of the UMC project. Dr. Nelson's involvement, however, was tempered by the goal and expectation of the Foundation that the collaboratives will become self-sufficient over time and will continue to serve teachers long after Ford funding terminates. In light of this goal and the increasing role of the Education Development Center in the day-to-day operation of the project, Dr. Nelson was less visible during 1989-90. Her changing relationship to the project is discussed in Chapter III.

The urban mathematics collaboratives have cultivated local resources--both financial and human--and have configured them in a variety of ways to explore new modes of professionalism for teachers and new kinds of relationships between mathematics teachers and mathematics professionals in higher education and in business. Considered individually, each collaborative is a unique, locally controlled project. But viewed as components of a wide-reaching national network, they comprise an efficient, cost-effective, and comprehensive field experiment that is enhancing participating teachers' knowledge and professionalism. It is a network that serves as a testing ground for new modes of thought and fresh approaches to larger issues of professional enrichment and subject-area expertise.

Consonant with the Ford Foundation's original intent, each of the collaboratives was encouraged to develop a unique program, drawing on local resources, exploiting local strengths, and addressing local weaknesses. As the effort continued, the UMC project focused more specifically on the effects of the developing networks on the professional lives of the participating teachers and on the identification of issue-based outcomes including a teacher leadership network, equity reform, and assessment reform. The

Foundation's intent in the UMC effort is in keeping with the recommendations of the Conference Board of the Mathematical Sciences (1984):

> The conference recommends the establishment of a nationwide collection of local teacher support networks to link teachers with their colleagues at every level, and to provide ready access to information about all aspects of school mathematics. (p. 5)

The broad sense in which the term *colleague* is used is exemplified by the objectives "strongly endorsed by the Conference":

> - to extend the sense of professionalism among teachers by building a support system that links them to colleagues in the mathematical sciences, inside and outside of the schools;
>
> - to provide teachers at all levels with colleagues upon whom they can call for information concerning any aspect of school mathematics; and
>
> - to enable teachers to enlarge their views of mathematics, their sources of examples, and their repertoire of classroom skills in communicating mathematics. (CBMS, 1984, p. 13)

Since the project's inception in 1984, the Foundation has been increasingly successful in its effort to involve participating teachers at each site in diverse activities and interactions that are planned and implemented to reflect the concerns and professional priorities of the teachers, as well as mathematicians from other educational settings, and from cultural and business institutions. In all cases, these activities and interactions have been designed to ensure that teachers are viewed as professionals who bring to the exchange their unique viewpoints, perspectives, and experiences, rather than as clients who "receive" information from other partners in the relationship.

In documenting the development of each of the eleven original collaboratives as well as that of the UMC Network as a whole, the Documentation Project collected data from a variety of sources during 1989-90. These sources included:

1. the directors and coordinators of each project;
2. the on-site observers from each project (reflecting the teachers' perspectives);
3. periodic site visits by the staff of the Documentation Project, and a final visit to each site during which people who had played a central role in the collaborative or had knowledge of the collaborative were interviewed;
4. discussions with teachers;
5. joint meetings with personnel from the Ford Foundation, the Documentation Project, the Technical Assistance Project, and the Outreach Project;
6. meetings of the UMC Steering Committee;
7. meetings of UMC project personnel, including the work sessions for project directors, project coordinators, and mathematics supervisors at the UMC Annual Meetings; at other gatherings; and at the Annual Meeting of the National Council of Teachers of Mathematics;
8. the electronic network operated by the Technical Assistance Project;
9. teachers at the UMC Teacher Leadership Workshop;
10. surveys administered to participating teachers; and
11. demographic questionnaires completed by the school districts.

This report presents an overview of the efforts of the UMC project as a whole, as well as a brief description of each of the eleven original collaboratives. The Appendix to the report includes a detailed summary report for each of the collaborative projects for the 1989-90 school year.

## II. PROJECT DESCRIPTIONS

A brief description of each of the eleven original Urban Mathematics Collaboratives is presented in this section. (A more detailed report of each collaborative is appended to this document.)

## Cleveland Collaborative for Mathematics Education ($C^2ME$)

Director: Barbara Patterson
Coordinator: Joseph Flynn (beginning August, 1989)
On-Site Observer: Robert Seitz
Funding Agent: The Cleveland Education Fund
Date of Initial Funding: February 1, 1985

The Cleveland Collaborative for Mathematics Education ($C^2ME$) was one of the five collaboratives established in 1985. The collaborative, which serves approximately 200 secondary and intermediate school mathematics teachers in the Cleveland Public Schools, is administered through the Cleveland Education Fund.

$C^2ME$'s purpose is to enhance the quality of mathematics education in the Cleveland Public Schools by finding new ways to integrate community resources into the teaching process and by defining new models for meeting the continuing professional needs of teachers. The collaborative has defined its mission as enhancing the professionalism and effectiveness of intermediate and secondary school mathematics teachers in the Cleveland Public Schools by providing opportunities for collegiality, training/professional growth, and curriculum development.

The Advisory Board and the Teacher Advisory Board provide input to the collaborative's director and project coordinator. The Advisory Board, which oversees the operation of $C^2ME$, is comprised of representatives of science, education, and business, as well as nine mathematics teachers from the Cleveland Public Schools. The Teacher Advisory Board was established in early 1986 to assist the collaborative in developing its long-range plans and future activities. Teachers were selected to serve on the Board based on their participation in $C^2ME$'s programs and their dedication to excellence in mathematics education in the Cleveland Public Schools. In 1989-90, 17 teachers served on the Teacher Advisory Board.

During the 1989-90 school year, $C^2ME$ offered a wide variety of activities designed to provide teachers with opportunities for training, information exchange, collegiality, and networking with their colleagues, as well as with mathematicians from business, industry, and higher education. The collaborative initiated a district-wide competition and awarded two high schools with $70,000 grants to implement their proposals for a Model Mathematics Project, sponsored a "Teachers by Teachers" workshop and two dinner symposia, offered support to the Problem-Solving Infusion Project to develop ways to incorporate problem-solving into the 7th- and 8th-grade mathematics curriculum, served as a conduit for the funding of the Aetna Mathematics Ride programs, initiated and supported mathematics contests, and provided funding for teachers to attend regional and national workshops and conferences. In addition, the collaborative continued to publish its own newsletter, encouraged participation in Cleveland's Teacher Internship Program, and encouraged teachers to apply for small grants provided by the Cleveland Education Fund. The collaborative's multipurpose Resource Center continued to offer a variety of services and support to Cleveland mathematics teachers.

## Durham Collaborative: The Durham Mathematics Council

Director: Dr. Keith J. Brown (until March 28, 1990)
Dorothy Doyle (April 1990 - August 1990)
Executive Director: Vivian Leeper-Ford (appointed October, 1989 through June 1990)
On-Site Observer: Betty Peck
Funding Agent: The North Carolina School of Science and Mathematics
Date of Initial Funding: August 1, 1985

The Durham Mathematics Council (DMC) was established in August, 1985, as the sixth collaborative in the Urban Mathematics Collaborative project. The collaborative, which servers 140 secondary and middle school mathematics teachers in the Durham City and County School systems, is administered through the North Carolina School of Science and Mathematics (NCSSM).

The Durham Mathematics Council is committed to mathematics education reform through teacher empowerment. The Council strives to encourage and stimulate teachers to effect change both in mathematics curricula and methodology, thereby empowering teachers to assume responsibility for their own professional practices and growth. It is the ultimate goal of the Durham Mathematics Council that teachers assume control of their own professional experience and status.

The Durham Mathematics Council operates under a dual governing structure--a Board of Directors and a Steering Committee--with the executive director serving as the primary liaison between the two governing bodies. The Board of Directors is the main decision-making body for the collaborative. The 18-member Board, comprised of representatives from area businesses, higher education, NCSSM, and the City and County Schools, including two teachers, sets policy, oversees fund raising, and allocates funds. The Steering Committee, comprised of one teacher from each school, creates ideas for programs, develops activities, and is beginning to assume a greater role in implementing programming ideas.

The Durham Mathematics Council offered a variety of in-school, out-of-school and networking activities during the 1989-90 school year. The out-of-school activities were designed to serve as the catalyst for mathematics reform; in-school activities focused on spurring reform, transforming it from idea to action; networking activities fostered collegiality among teachers and area mathematicians and provided professional support and resources to teachers working toward mathematics reform. Collaborative programs included an opening reception for the new school year, a dinner meeting which focused on the NCTM *Professional Standards for Teaching Mathematics*, a "Show and Share" mini conference, a workshop on "Writing in the Mathematics Curriculum" and a reception for guest speaker Dr. Arthur Powell, a day-long seminar at IBM to introduce teachers to new mathematics education software, and teacher networks in five subject areas within mathematics. In addition, DMC offered funding to secondary and middle school mathematics teachers through its Travel Grants, University Study and Independent Work Grants, and Mini-Grants programs. Travel grants enable members of the Council to attend state, regional, and national conferences; University Study grants support mathematics-related university coursework; Independent Work grants provide teachers with summer funding for curriculum or materials development; and Mini-Grants fund the purchase of classroom materials. The collaborative also operated a Teacher Resource Center that provides teachers access to computers, software, videotapes, manipulatives, texts, and supplemental materials, and loans a computer system to teachers for extended use in the classroom. During 1989-90, the DMC published seven editions of its collaborative newsletter.

## Los Angeles Urban Mathematics/Science/Technology Collaborative

Executive Director: Peggy Funkhouser
Project Director: Toby Bornstein
On-Site Observer: Richard Curci
Teachers Coordinators: Kathy Blackwood (appointed March, 1989 to February, 1990)
Joan Hairston (appointed February, 1990)
Funding Agent: Los Angeles Educational Partnership (LAEP)
Date of Initial Funding: February 1, 1985

The Los Angeles Urban Mathematics/Science/Technology Council (LAUM/S/TC) was organized in mid-1986 as a result of the restructuring and reorientation of the Los Angeles Urban Mathematics Collaborative, which was one of the five collaboratives established in 1985. LAUM/S/TC is the official title of the 57-member Advisory Committee, which reported to its funding agent, the Los Angeles Educational Partnership (LAEP). During 1989-90, a small advisory committee reformulated the organizational structure of the Council to serve four LAEP programs: +PLUS+ (Professional Links with Urban Schools), Industry Initiatives in Science and Mathematics Education (IISME), the Model Technology Project, and Target Science. The +PLUS+ project constitutes the urban mathematics collaborative as originally initiated through funding from the Ford Foundation.

The collaborative has focused its attention on high schools in five districts: The Los Angeles Unified School District (LAUSD), El Monte Union High School District, Inglewood Unified School District, Pasadena Unified School District, and Long Beach School District. In light of the massive target population, the collaborative's +PLUS+ project focused initially on the mathematics departments in three high schools. During the collaborative's first year, the departments in these schools formed +PLUS+ teams with local business and post-secondary associates. By the end of the 1988-89 school year, there were a total of 21 +PLUS+ departments. In 1989-90, eight mathematics departments joined the +PLUS+ department component bringing the total to 29 +PLUS+ departments. Each department, with the exception of the eight that joined the collaborative during the 1989-90 school year, is represented on the Teachers' Council, a forum for departmental leadership that meets once a month during the school year. At the end of the 1989-90 school year, the Teachers' Council was divided into four satellite councils each serving a cluster of five or six schools.

The +PLUS+ project's goal is to broaden teachers' mathematical horizons by encouraging them to interact with their colleagues in a mathematics resources network, and to help them relate the mathematics curriculum to the world of work. +PLUS+ focused on improving the mathematics programs of the 29 high schools, with the +PLUS+ team in each target school either preparing or executing plans for an enhanced curriculum. Considerable effort has been expended in building these teams, with the goal of fostering and consolidating departmental cohesion. As a prerequisite to receiving financial support to implement its plan, each department agreed to define needs, explore resources, and develop a program of activities. In addition, the eight departments that joined the collaborative in 1989 were required to host department site meetings at their schools.

Another major effort of +PLUS+ for 1989-90 was directed towards the fourth annual +PLUS+ Workshop Series. Mathematics teachers from all Los Angeles County Schools are eligible to attend, although emphasis is placed on encouraging teachers from the four targeted school districts to participate. Under the auspices of the +PLUS+ project, a steering committee comprised of teachers planned this year's series.

During the 1988-89 school year, the collaborative coordinated the Jaime Escalante Mathematics Teacher Award Program and a series of classroom demonstration lessons by +PLUS+ teachers. The collaborative also sponsored an annual conference for teachers from +PLUS+ departments. In addition, TELE-Venture, the electronic bulletin board which allows free exchange of information among the mathematics teachers at +PLUS+ schools, was expanded to include the new +PLUS+ departments as well as district instructional specialists. The collaborative sponsored a Woodrow Wilson one-week summer institute on mathematical modeling and follow-up workshop, funded attendance of +PLUS+ teachers at several local and national workshops and conferences, and encouraged teachers to apply for grants offered through the LAEP. The collaborative also published a monthly newsletter.

## Memphis Urban Mathematics Collaborative

Executive Director: Herman Ewing
Project Coordinator: Nancy Gates
Associate Coordinator: Anne White
On-Site Observer: Rita Ross
Funding Agent: Memphis Urban League, Inc.
Date of Initial Funding: September 1, 1986

The Memphis Urban Mathematics Collaborative (MUMC), established in September, 1986, was the last of the 11 collaboratives to join the UMC project. The collaborative serves the more than 300 middle, junior high, and senior high school mathematics teachers as well as 200 teachers in eight elementary schools in the Memphis City Schools. Of these, approximately 350 teachers were considered collaborative members. The collaborative is administered through the Memphis Urban League, Inc.

The Memphis collaborative's goals are to promote an environment of professionalism; to establish closer creative working relationships with other professionals in elementary and secondary schools, colleges, and universities, and in business and industry; and to promote greater public awareness of the work of the MUMC and its constituents. The collaborative will continue to develop projects to broaden teachers' horizons and to seek additional financial commitment and moral support from the administration of the Memphis City Schools.

The collaborative's organizational structure has evolved gradually since 1986. The collaborative is governed by a 25-member Governing Committee comprised of 11 teachers; 5 mathematics professors and representatives from higher education; 5 representatives from business and industry; 3 from the school district administration; and the director, who also represents the Urban League. The project coordinator and associate coordinator attend the Governing Committee meetings, but are not official members of the group. An Operating Committee of eight teachers helps to identify, plan, and coordinate activities.

During the 1989-90 school year, the collaborative offered a wide array of activities, programs, and services to elementary, middle school, junior high, and high school mathematics teachers in the Memphis City Schools. These included a 1989 *Geometric Supposer* summer workshop, a Fall Workshop Series for Professional Growth Credit, two Grant-Writing Workshops, a Woodrow Wilson Institute follow-up session, a workshop on "Hands-On Equations," an IBM Technology Conference and dinner, and an IBM Mathematics Software Seminar. The collaborative also offered a six-day workshop during June, 1990, on "Mathematics Made Meaningful"; it held a Family Math night; and it cosponsored a dinner symposium on mathematics as communication for minority students, for members of the MUMC Governing Board, and for selected guests. In addition, the collaborative funded teachers' attendance at a variety of professional activities, including a June 1990 Woodrow Wilson Institute on Mathematics Modeling and the NCTM annual and regional meetings, as well as several conferences held in the summers of 1989 and 1990. During the summer of 1989, four teachers participated in the Teacher Internship Program. The collaborative has continued to publish its semiannual newsletter.

## New Orleans Mathematics Collaborative

Director: Kimberley Sawyer
Coordinator: Dr. Olympia Boucree
On-Site Observer: Aldonia Winn-Belton
Funding Agent: The Metropolitan Area Committee (MAC) Foundation
Date of Initial Funding: September 1, 1986

The New Orleans Mathematics Collaborative (NOMC), established in 1986, was the tenth of the eleven collaboratives to be funded by the Ford Foundation. The collaborative, which serves the approximately 150 senior high school and 136 junior high and middle school mathematics teachers in the New Orleans Public Schools, is one of four programs coordinated by the Metropolitan Area Committee Education Fund.

The collaborative's aim is to enhance the professional development of mathematics teachers and to enrich the teaching of mathematics in New Orleans' public secondary, middle, and junior high schools. To accomplish these goals, the collaborative has provided teachers with opportunities to develop networks with mathematicians from business and higher education, to work in collaboration with other teachers and mathematicians, to stay abreast of new developments in mathematics and teaching, to understand the importance of mathematics in "real world" settings, and to develop leadership in creating change.

The collaborative is governed by a 22-member Steering Committee comprised of teachers, district administrators, and representatives from the teachers' union, businesses, universities, and the Louisiana Science Centre. The chair of the Committee, who is chief executive officer of Shell Offshore, Inc., also sits on the MAC Education Fund Board. Four subcommittees--the Site Visit/Internship Subcommittee, the Workshop Subcommittee, the Symposium Subcommittee, and the Newsletter Subcommittee--oversee collaborative activities. The Teacher Advisory Council, established in 1987, is composed of a teacher representative from each of the 37 core curriculum senior, middle, and junior high schools. The Council allocates funds that enable teachers to attend conferences, provides input in identifying activities of potential interest to teachers, and serves as a conduit for the flow of information between the collaborative and teachers.

During the 1989-90 school year, the primary activity of the New Orleans Mathematics Collaborative was the work of the Teacher Leadership Council. This group planned a mini-conference to be held in November, 1990; wrote and received funding for a $10,000 outreach grant from EDC; developed positions on state and district policies; and sent emissaries to the state legislature's Education Committee to learn more about influencing that body. A Woodrow Wilson one-week science institute was sponsored and the Industry Internship Program was expanded. One issue of the newsletter was published. The collaborative encourages teachers to apply for mini-grants and sponsored teachers' attendance at regional and national conferences. Collaborative teachers were used by the district to lead workshops.

## Philadelphia Math Science Collaborative

Co-Director: Dr. Fredrick Stein
Co-Director: Dr. Wayne Ransom
Coordinator: Joseph Merlino (Appointed October 5, 1989)
Consultant: Sue Stetzer (Until December, 1989)
On-Site Observer: Ms. Joyce Neff
Funding Agent: The Franklin Institute
Date of Initial Funding: February 1, 1985

The Philadelphia Math Science Collaborative was created in fall, 1986, through a restructuring and reorientation of the Philadelphia Mathematics Collaborative, one of the five collaboratives established in 1985. In 1989-90, the administration of the collaborative, which serves mathematics and science teachers in the School District of Philadelphia, was transferred from the Franklin Institute to PATHS/PRISM. During the 1989-90 school year, the number of its target schools increased from 9 to 20.

The primary goals of the Philadelphia Math Science Collaborative are to promote teacher leadership and team building and to contribute to a vision of mathematics and science teaching in the future. The collaborative's goals have evolved to reflect renewed commitments: (1) to foster communication among teachers; (2) to serve as a catalyst for innovation and change; and (3) to increase teacher participation in extramural professional development programs that offer partnerships between teachers and their colleagues in academia and industry, opportunities to enhance knowledge, skills, and professionalism, and new ideas for mathematics instruction. The collaborative also hopes to develop a model for documenting the impact of these two programs on the quality of teachers' professional lives.

The Program Planning Committee was reconstituted in December, 1989. The group consisted of up to 70 teachers who volunteered to plan and provide leadership for the collaborative. Through their participation in this group, teachers and department heads became the decision makers for the collaborative. With the empowerment of the Program Planning Committee, the Steering Committee assumed an advisory role for the collaborative. The Steering Committee is composed of a teacher and department heads from the target schools, as well as representatives from local colleges, businesses, the school district, PATHS/PRISM (Philadelphia Alliance for Teaching Humanities in the Schools and Philadelphia Renaissance in Science and Mathematics) and other professional organizations.

In addition to encouraging teachers to participate in the enrichment opportunities available to them in the Philadelphia area, the collaborative sponsored several activities during the 1988-89 school year. These programs included grants to fund teachers' attendance at professional meetings, workshops, and seminars; the Mathematics, Science and Technology Conference, which focused on integrating technology into the curriculum; Woodrow Wilson institutes; assistance and support for teachers wishing to apply for PATHS/PRISM grants; a monthly calendar and newsletter; Hi-Tech Talk Computer Link; and a clearinghouse service that keeps teachers notified of resources for classroom use.

## Pittsburgh Mathematics Collaborative

Project Coordinator: Dr. Leslie Salmon-Cox
Collaborative Liaison: Barbara Bridge
On-Site Observer: Rosemarie Kavanagh
Funding Agent: Allegheny Conference on Community Development
Date of Initial Funding: September 1, 1985

The Pittsburgh Mathematics Collaborative, the seventh collaborative to be funded, was established in 1985 to serve the 115 high school mathematics teachers in the Pittsburgh public schools. The collaborative is administered through the Allegheny Conference Education Fund, which is administered by the Allegheny Conference on Community Development.

The collaborative's efforts focus on six goals: to overcome teachers' isolation by providing increased opportunities for interaction; to educate the community as to the professionalism of high school mathematics teachers; to enhance teachers' knowledge of mathematics and its applications; to provide teachers with opportunities for professional self-enhancement; to provide opportunities for teacher recognition; and to provide time for teacher interaction, work, and professional development. These goals are envisioned as positive steps toward institutionalizing structures and processes that will continually foster teacher professionalism and that will be decreasingly reliant on external administration and facilities. By the close of the 1989-90 school year, Pittsburgh is to have an energized secondary mathematics faculty; a community knowledgeable about secondary mathematics issues; a series of mechanisms to promote interaction among teachers and community leaders; and a public more aware of the importance of mathematics.

Collaborative governance is shared among five bodies: the Steering Committee; its Executive Committee, called the "First Tuesday Committee"; the Collaborative Liaison Committee; the Secondary Instructional Teacher Leaders from each of the 12 high schools; and the Middle School Instructional Teacher Leaders from each of the 16 middle schools. The 27-member Steering Committee, comprised of teachers, school district administrators, college and university faculty members, and representatives from various community councils, corporations, and foundations, had met annually in previous years but did not meet in 1989-90. The Executive Committee, comprised of two collaborative staff members and three administrators from supporting agencies, meets the first Tuesday of each month to plan and review the daily operations of the collaborative. The Liaison Committee, made up of one representative from each high school, meets monthly during the school year. The Instructional Teacher Leader Groups meet monthly during the school year to plan and evaluate specific activities. The Instructional Teacher Leaders also serve as the major communication channel between the collaborative and the teachers.

During the 1989-90 school year, the Pittsburgh Mathematics Collaborative offered a variety of activities and programs designed to enhance professionalism and collaboration among secondary and middle school mathematics teachers and professionals in the mathematical sciences, as well as to provide teachers with information about mathematics applications. The extension of services to middle school teachers is facilitated by the Middle School Mathematics Project, which was initiated in 1988 through a grant from the National Science Foundation. Collaborative activities included a kick-off picnic, several presentations and receptions, inservice programs, curriculum committee meetings, and a math-intensive partnership program. In addition, the collaborative received a $10,000 grant from the UMC Outreach Project to develop the interpersonal skills of a core of secondary mathematics teachers. In February, 1990, the collaborative purchased modems for each high school to enable teachers to network with each other. The collaborative promoted Mathematics Awareness Week and encouraged teachers to apply for professional development grants that enabled them to take advantage of a variety of opportunities, including attendance at professional conferences and workshops.

## St. Louis Urban Mathematics Collaborative

Director: Dr. Helene Sherman (through July, 1989)
Jerome Burke (appointed August 1, 1989)
Council Chairperson: Anita Madsen
On-Site Observer: Donald Thompson
Funding Agent: Mathematics and Science Education Center
Date of Initial Funding: April 15, 1986

The St. Louis Urban Mathematics Collaborative was one of the four collaboratives established in 1986. The collaborative, which serves the 114 secondary mathematics teachers and computer science teachers and 85 middle school mathematics teachers in the St. Louis Public School District, is administered through the Mathematics and Science Education Center (MSEC). The center, which was established in the fall of 1986, assists schools and school districts in administrating mathematics and science programs.

The primary goals of the collaborative focus on providing mathematics teachers with opportunities: (1) to explore business-, industry-, and university-based resources for the purpose of determining how these resources may be used to assist them in their professional growth and in their classroom instruction; (2) to design and implement staff development programs for themselves and for their peers; (3) to improve communication and information exchange among mathematics teachers, both within and across schools; and (4) to promote recognition of accomplishments and quality performance among all mathematics teachers and their students. These goals were derived from the expectations of the secondary mathematics teachers that the collaborative would improve their knowledge of mathematics and its applications and increase their communication, collegiality, instructional expertise, and sense of professionalism.

The collaborative operates under the direction of the Collaborative Council. The Council meets once each month to discuss, plan, and evaluate collaborative events; nearly all decisions affecting the collaborative are determined by Council vote or general consensus. During the 1989-90 school year, the Council was comprised of teachers from the St. Louis Public Schools, representatives from the academic and business communities, the district's mathematics supervisor, the director of the Partnership Program, a representative of the school district's Division of Technology Development, and the collaborative's director.

During the 1989-90 school year, the collaborative sponsored a wide variety of activities for secondary and middle school mathematics teachers in the St. Louis Public Schools, including a computer seminar series, a dinner symposium, the third annual Mathematics Fair, the Secondary Mathematics Contest, and two informal interaction sessions. The collaborative also participated in the Veiled Prophet Fair, MATH COUNTS, and inservice programs sponsored by the St. Louis Public Schools. In addition, the collaborative sponsored attendance of mathematics teachers at a variety of local, regional, and national workshops and conferences.

## San Diego Urban Mathematics Collaborative

Director: Prof. Alma Marosz (until May 9, 1990)
Director/Coordinator: William Wible (beginning May 9, 1990)
Coordinator: Dr. Barbara Wyman (through March, 1990)
On-Site Observer: Dr. Sharon D. Whitehurst
Funding Agent: San Diego State University Foundation
Date of Initial Funding: April 15, 1986

The San Diego Urban Mathematics Collaborative, established in spring, 1986, is administered through the San Diego State University Foundation. During the 1989-90 school year, the collaborative served approximately 150 mathematics teachers from 9 targeted schools: 5 senior high schools and 4 feeder junior high schools in the San Diego Unified School and Sweetwater Union High School districts.

The collaborative's primary goal has been to improve the professional lives of mathematics teachers in the San Diego area by reducing their isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community. In 1989-90, the collaborative revised its major goal to focus on the reform in urban mathematics education that was projected to evolve within a framework of equity and excellence for all students.

The collaborative is governed by a Board of Directors and a Council of Mathematics Educators. The Board of Directors is responsible for setting policy while the Council, composed of representatives from the target schools, develops the program. The collaborative was administrated by a director and a coordinator. In June, 1990, these two positions were combined into a single coordinator/director position.

In addition to encouraging teachers to take advantage of a wide array of local resources, the collaborative hosted a retreat for all collaborative members and a social hour and dinner for members of the collaborative's Board of Directors, sponsored a workshop on contemporary applied mathematics, and co-sponsored a colloquium on the draft of the NCTM's *Professional Standards for Teaching Mathematics*.

The collaborative also encouraged and helped to facilitate teacher applications for grants and scholarships and offered stipends to teachers to enable them to attend several conferences and workshops, including the annual fall conference of the Southern Section of the California Mathematics Council, the national NCTM conference, and the summer Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy in New Hampshire.

## San Francisco Mathematics Collaborative

Executive Director: Gladys Thacher (through June, 1990)
Susan Cornell Wilkes (effective September, 1990)
Director of Programs and Evaluation: Judith Massey Morales (through December, 1989)
Amy Rodriguez Lee (appointed January, 1990)
Project Director: Lise Dworkin
On-Site Observer: Dan Bennett (July, 1989-June, 1990)
Funding Agent: San Francisco Education Fund
Date of Initial Funding: February 1, 1985

The San Francisco Mathematics Collaborative was one of the five collaboratives established in 1985. The collaborative, which was expanded during the 1988-89 school year to serve the 1,500 K-12 teachers of mathematics in the San Francisco Unified School District, is administered through the San Francisco Education Fund (FUND) in close cooperation with the San Francisco Unified School District.

The vision of the San Francisco Mathematics Collaborative is one in which teachers are motivated, knowledgeable, and accountable to their colleagues and to their students in their effort to become the best mathematics educators possible. The basic objectives of the collaborative in achieving this vision are defined as: creating opportunities for meaningful dialogue among mathematics teachers in grades K-12; providing a "safehouse" where teachers can freely express their needs and concerns; providing teachers with opportunities for professional development and collegiality based upon a shared concern for mathematics education; developing a structure in which teachers can take the initiative in the improvement of mathematics teaching and learning; creating a vehicle for community investment in quality mathematics education in San Francisco schools; and providing opportunities for teachers to discuss equity issues and the role of the collaborative in addressing these issues.

The Collaborative Council is the decision-making body for the collaborative. The Council has 29 members listed of whom 22 are voting members listed on its roster, including 12 teachers, 2 representatives of mathematics teachers associations, 1 school district representative, 1 FUND representative, 1 Exploratorium representative, 2 representatives from higher education, and 3 representatives from the business community. Beginning in June, 1989, the Council met monthly to plan direction, policy, and activities for the collaborative. The new full-time project director is responsible for managing the day-to-day activities of the collaborative.

During the 1989-90 school year, the San Francisco Urban Mathematics Collaborative offered a wide variety of activities to enable K-12 teachers of mathematics to establish networks with their peers and with other professionals and to increase their awareness of the developing world of mathematics and its applications. The collaborative sponsored a kick-off event in the fall to publicize the fact that it had become a K-12 organization and was a co-sponsor of an extremely successful K-12 spring mathematics conference. A series of four workshops on graphing calculators enabled teachers to receive training on the latest use of advanced calculator technology. Saturday morning workshops that addressed topics in the NCTM *Curriculum and Evaluation Standards* offered teachers important guidelines for improving mathematics instruction in their classrooms. A three-part workshop series on important issues and ideas of the national mathematics education reform movement brought teachers together with recognized leaders in the reform movement, offered teachers valuable insights into current efforts to reform mathematics, and provided an opportunity for collegiality. The collaborative assisted teachers in applying for minigrants, small grants, and school team grants awarded by the San Francisco Education Fund to support projects that would enrich students' mathematics education. The collaborative also provided funds for teachers to attend local and national conferences and institutes offered by other organizations.

## Twin Cities Urban Mathematics Collaborative

Governing Board Chair: Steven Watson
Administrative Director: Prof. Harvey B. Keynes
Project Coordinator: Dr. Philip Carlson (through August, 1989)
On-Site Observer: Gerry Sell
Funding Agent: School of Mathematics, University of Minnesota-Minneapolis
Date of Initial Funding: February 1, 1985

The Twin Cities Urban Mathematics Collaborative (TCUMC) was one of the five collaboratives established in 1985. The collaborative, which serves the approximately 260 junior and senior high school mathematics teachers in public, private, and parochial schools within the boundaries of the Minneapolis and St. Paul school districts, is administered through the School of Mathematics at the University of Minnesota.

Since its inception, the collaborative has directed its efforts toward helping teachers exercise more control over their professional lives; providing professional and educational opportunities for teachers; expanding the involvement of business and industry; integrating its efforts with those of other mathematics education organizations; and increasing its visibility, especially within the school districts. The collaborative's goals for the 1989-90 school year evolved from the 1988-89 goals: sponsoring a broad range of mathematics activities; making the transition to the new governance structure; identifying a coordinator; developing a strategy for fund raising; and attempting to acquire nonprofit, tax-exempt 501(c)3 status.

The collaborative operates under the guidance of the Governing Board and Building Representative's Group. The 14-member Governing Board was chaired by Steven Watson. Members of the Board include teacher representatives, the administrative director, the executive director of the Minnesota High Technology Council, two representatives from higher education, the district mathematics consultants, a member of the Board of Education, and two representatives from business and industry. The Building Representatives group, which discusses issues and makes recommendations to the Governing Board, consists of 36 teachers, one from each public high school and junior high school in Minneapolis and St. Paul, and one from each of the seven private and parochial schools. These members serve as collaborative emissaries to teachers in their home schools. The group has its own budget to fund activities.

The collaborative is directed by Steven Watson. Professor Harvey Keynes, University of Minnesota, is the Administrative Director and oversees the collaborative's finances. Dr. Philip Carlson, a staff member of the Special Projects Office of the Mathematics Department of the University of Minnesota, was appointed as the part-time coordinator for the 1988-89 school year and continued until September, 1989. In February, 1990, James Whitney, a consultant to the High Technology Council from Honeywell, Inc., was appointed as a consultant to the collaborative to serve as coordinator.

During the 1989-90 school year, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for junior and senior high school mathematics teachers. These included a Woodrow Wilson Summer Institute in July, 1989, and a follow-up workshop in February, 1990, a series of three dinner meetings sponsored by the Twin Cities Mathematics Society (TCMS), a Leadership Conference for members of the Governing Board and Building Representatives, and two workshops on graphics calculators. The collaborative also supported teachers' attendance at a variety of local, regional, and national conferences and workshops. Three TCUMC teachers participated in the 1989 Woodrow Wilson Summer Mathematics Institute at Princeton University; two teachers participated in a minicourse on the graphing calculator at the University of Minnesota, as part of the Conference for Mathematics Reform for College Teachers; one TCUMC teacher attended the EDC Teacher Leadership Workshop in Newton, Massachusetts; and eight TCUMC teachers received stipends to attend the Annual Meeting of the National Council of Teachers of Mathematics (NCTM) in Salt Lake City, Utah. In addition, two issues of the collaborative newsletter, an important networking component of the project, were published and distributed.

## III. THE UMC NETWORK

As the Ford Foundation's financial support draws to an end, the UMC project has matured into a body actively addressing critical issues. The eleven original sites are all positioning themselves to develop the funding that will enable them to continue their collaborative efforts. Some are trimming activities and setting priorities in order to focus on essentials that can be managed with the remaining Foundation funds and local funds. Three replication sites, a second generation of collaboratives, have been added to the project and benefit from the experiences and knowledge of the original sites as they forge working networks in their communities. The enterprise is becoming a confederation governed by a committee of representatives from all of the sites. Through the committee's position papers on equity in the mathematics curriculum, teacher professionalism, and student assessment, common beliefs among the members are being articulated.

As an explicit element of the Ford Foundation's vision of change, the collaboratives have been connected by a shared support system to which they could turn for services, ideas, help and direction. This support system was comprised of the program officer from the Ford Foundation, staff from the Technical Assistance and Outreach Projects at the Education Development Center, Inc. (EDC), in Newton, Massachusetts, and members of the Documentation Project at the University of Wisconsin-Madison. The services they provided, as well as the support the individual sites provided to one another, were directly affected by and helped to define the total UMC project. Their cooperative efforts have contributed to a cohesion and sense of common purpose that link all of the collaboratives.

The support system that was created to launch the project and support its development changed during 1989-90. At that time, the program officer from the Ford Foundation, Barbara Scott Nelson, turned over the reins of the project to EDC, limiting her involvement to coordinating with EDC the approval of the permanence proposal of the final two sites seeking permanent status. In the summer of 1990, she left the Foundation to assume a position at EDC. During 1989-90, EDC became responsible for management of the collaborative project, situating it with other reform efforts, helping to structure management at the individual sites, and linking the UMC to organizations outside the enterprise. During 1990, the Documentation Project completed its data gathering, including administering a large scale survey and final debriefings of collaborative participants at each site.

The UMC project is a national network recognized by project administrators and teachers within individual sites as a key contributor to the development of collaboration on a variety of levels. The UMC Standing Committee, which was formed in May, 1989, to strengthen the national network of the Urban Mathematics Collaborative, met three times during the year. The directors, coordinators, district mathematics supervisors, and teacher leaders each met with their respective groups once or twice during the year. By 1989-90, all the sites were linked by electronic mail; the project newsletter, *<ANGLES>*, was published three times during the year, and these issues, as well as a special follow-up report on the NCTM Annual Meeting, were distributed to all sites. The UMC support network is available to the collaboratives as needed and has been a valuable resource to the eleven original collaboratives in developing and implementing their proposals for permanence, as well as to the three replication sites.

As the UMC project matured, teachers have become more active participants in the national network. EDC invited collaborative teachers to the 1990 UMC Annual Meeting as well as to special sessions at the NCTM Annual Meeting. EDC has provided encouragement and financial support to enable teachers to attend a variety of conferences, workshops, and UMC activities, including two Teacher Leadership Workshops that EDC hosted in 1989 and 1990. As a result, teachers at each site have become acquainted with their peers at other sites, and the foundations of a broad-based collegial network have been established.

As the impacts and value of the UMC project are considered, it is essential that analysis be based on a firm understanding of the organizational context in which it operates; evaluation must consider not only the contributions the UMC support system has made to each of the eleven original sites, but its own progress and development as well.

During 1989-90, the EDC support system moved toward permanence with the same deliberation and self-evaluation exhibited across all of the individual sites. In 1988-89, primary responsibility for project operations had begun to shift from the Ford Foundation to EDC. By June, 1989, EDC was managing the UMC network while the Ford Foundation was primarily involved in giving final approval to the permanence grant for the last two of the eleven original collaboratives. These grants were issued by April, 1990. During the transfer, the Technical Assistance Project and Outreach Project devoted extensive time and energy to identifying commonalities among the sites and the future direction for the UMC project as a whole. As a result of these efforts, by the end of the 1989-90 school year the Standing Committee was in full operation, the UMC annual meetings were focusing on a particular topic or theme, and the groups--collaborative directors, coordinators, mathematics supervisors and teacher leaders--had developed a sense of cohesion.

In August, the Outreach Project awarded $8,000 collaborative planning grants to three of the five sites that had submitted replication proposals in June, 1989. The expansion of the UMC network to the three new sites suggests that the collaborative model can be replicated in a wide variety of educational environments, even without substantial funding. The applicability of the collaborative concept to changing situations and environments enhances the UMC project's potential for impact. The Outreach Project will invite other urban sites to submit proposals during the 1990-91 school year and one final replication site will be identified, bringing the number of collaboratives in the national network to fifteen. It is expected that the future replication site will need a strong connection to and an understanding of the broad view of collaboration in addition to sources for additional funding.

As part of the Outreach Project's effort to bring the significant gains that were being made at individual sites to the attention of the wider community of education reform and to help the sites strengthen the link between their local initiatives and state and national reform, in the winter of 1989-90 the Outreach Project conducted an open competition for small grants (up to $10,000 each). The Outreach Action Grants were awarded to support activities in the categories of teacher research, education policy initiatives, and networking activities. The six proposals that received either full or partial funding presented a broad array of teacher-initiated and teacher-centered change initiatives. The submission of eleven proposals in response to the grant announcement demonstrates that a large number of UMC teachers are prepared to take on leadership roles in mathematics reform. A second round in the Outreach Action Grants competition will be held in the 1990-91 school year with a different focus: Projects are to be targeted toward research, policy, and reform related to the three areas of teacher professionalism, equity in the mathematics program, and student assessment.

The Technical Assistance Project continued to support and assist each individual site in attaining its own vision of permanence, including direct intervention to assist three sites in facilitating their permanence process. The TAP focused more on working with particular groups in the network, including the mathematics supervisors and the teacher leaders.

During 1989-90, the Documentation Project completed its final year of data collection, with the on-site observers' appointments officially ending on June 30, 1990. In addition to its regular activities for the on-going collection of information about each of the sites, during 1989-90 the Documentation Project administered a final Survey on Teacher Professionalism to identify changes in teachers' views about teaching as a profession as a result of their participation in collaborative activity. A Demographic Survey, the second during the five-year period of data collection, was sent to participating school districts. In preparing a final site report that summarizes the evolution of each collaborative from 1985 through June, 1990, and a book-length reflective analysis of the entire UMC project, the staff of the Documentation Project conducted a final site visit at each of the eleven original sites to record individual perspectives on the impact of the collaborative, as well as anticipated and unanticipated outcomes of the project.

During 1989-90, the UMC support system completed a period of transition. It is in this context that the efforts of each of the system components is described below.

## Ford Foundation

The transfer of the control and supervision of the UMC project from Project Monitor Barbara Scott Nelson and the Ford Foundation to EDC was completed during the 1989-90 school year. Funding and grant decisions for two of the eleven original collaboratives remained with the Ford Foundation until their final approval in February. The day-to-day project operations were contracted to EDC in September, 1988. This transfer of duties was evidence that the project monitor had determined that the UMC project was stabilized and did not need her constant attention. The transfer of responsibilities to EDC signified a step towards the development of a permanent configuration for the UMC project. Although the decision to assign this responsibility to EDC was the result of an EDC proposal to the Ford Foundation in the spring of 1988, it had been anticipated by Dr. Nelson from the early stages of the project that EDC would assume this responsibility. From the inception of the project, it was envisioned that the Ford Foundation would play an operational role only in the formative stages.

## Technical Assistance Project (TAP)

The Technical Assistance Project, under the direction of Dr. Mark Driscoll of the Education Development Center (EDC), provided support and resources to the eleven original collaboratives as well as to the three new sites. Dr. Driscoll was assisted during 1989-90 by TAP Research Associate Grace Kelemanik and Administrative Assistant Sheila Flood. In addition to serving as a general resource to the projects, the TAP scheduled and sponsored meetings for groups of collaborative members; managed the electronic network; helped to identify and sponsor guest speakers for various collaborative events; assisted individual collaboratives in organizing conferences; helped fund teachers' attendance at national meetings; intervened to assist collaboratives in defining and implementing their approach to permanence; and networked with leaders in mathematics and mathematics education. In addition, in 1989-90, the Technical Assistance Project cosponsored a Teacher Leadership Workshop with the Outreach Project to assist collaborative teachers in their efforts to leverage changes both inside the classroom and out.

The Technical Assistance Project's proposal to the Ford Foundation identified three primary objectives for the 1989-90 school year. The first was to build a series of activities around three central issues: mathematics reform, equity, and teacher leadership. The second objective was to facilitate communication across the UMC network, and between the UMC network and other education reform networks. The third objective was to assist in the evolution of governance--within individual collaboratives and across the network as a whole. These three objectives indicated a change in focus by the Technical Assistance Project from previous years. Prior to 1989-90, the TAP was a source of information and resources that could be called upon by collaboratives. In 1989-90, the original collaboratives had evolved to a stage where less individual assistance was needed. This provided the opportunity for the TAP to turn its attention to serving the UMC network as a whole by providing leadership in addressing common issues among the collaboratives, furthering the communication among sites, and strengthening the network's governance.

## Three Focal Issues: Mathematics Reform, Equity, and Teacher Leadership

### Mathematics Reform

The Technical Assistance Project has built on the initiative and momentum created by the NCTM *Curriculum and Evaluation Standards for School Mathematics* to support reform efforts by local collaboratives. TAP's role has been to consult with collaborative staff and mathematics supervisors to help generate and plan for changes in the mathematics curriculum. Some efforts of the TAP have been directed toward individual collaboratives. For example, members of the Technical Assistance Project worked with the St. Louis collaborative as it sought to develop with the school district a curriculum for a mathematics-science magnet school. The TAP staff also consulted with people from the Philadelphia collaborative as they worked with the district in restructuring the 9th-grade mathematics curriculum.

A major effort of the TAP to further mathematics reform has involved its work with the mathematics supervisors. Meeting with collaborative mathematics supervisors as a group twice during 1989-90, TAP staff has facilitated communication among its members, helped to strengthen the relationship between the collaboratives and the districts, and helped the supervisors focus on common issues. One main focus of this group has been on assessment. The result has been that the mathematics supervisors have gained knowledge about current changes in assessment and have submitted a preliminary proposal for NSF funding to support the professional development of teachers as a key factor in assessment reform.

On the UMC network level and in cooperation with the Outreach Project, members of the Technical Assistance Project have been integral to the process of preparing the UMC position papers. One underlying purpose of these papers is to clearly define equity and assessment issues as viewed by the collective UMC network in the effort to assure that these issues will be incorporated into mathematics reform by the local districts. The mathematics supervisors are considered important links between the districts and the UMC network if this effort is to be successful.

As stated in its 1990 report to the Ford Foundation, the TAP in its future work in the area of mathematics reform faces two primary challenges: to bring evident and substantial change in mathematics education to schools and classrooms; and to help individual collaboratives survive over the next few critical years--until real local policy changes take root.

## Equity

Equity has been a concern of the UMC project from its beginning. The Technical Assistance Project has continued to ensure that equity be addressed in the gatherings of the UMC network and by the individual collaboratives. In 1989-90, equity was one of the important thrusts of the network with the Technical Assistance Project providing the impetus. In preparation for the Teacher Leadership Workshop, teachers were asked to talk with other teachers in their collaborative and bring equity concerns from their district and collaborative to the workshop. A major theme of the UMC annual meeting in Los Angeles was to explore a multicultural approach to equity issues. National experts were included on the agenda along with practitioners who reported on successful models. Manuel Fernandez, director of a school integration support program in Massachusetts, was the major speaker at the UMC sessions held in conjunction with the NCTM Annual Meeting in Salt Lake City. He discussed efficacy strategies for students and teachers, focusing the teachers' attention on the issue of classroom expectations. One of the three UMC position papers, as has been noted, is devoted to equity in mathematics education that in a revised version begins with the statement, "The Urban Mathematics Collaboratives (UMC) believe that all students can and must learn mathematics."

The constant prodding by the Technical Assistance Project and others on equity as well as the exposure to nationally-recognized speakers in this area has resulted in some action by the collaboratives. At the close of the 1989-90 school year, four of the collaboratives--Los Angeles, San Francisco, New Orleans, and Twin Cities--were exploring ways to involve Manuel Fernandez at their sites. For example, New Orleans was arranging to have him as the key note speaker at a mini-conference to be held in

November, 1990. These and other collaboratives are making a greater effort to gather local school district data that bear on questions of equity in mathematics education. The Memphis collaborative chose equity as the focus of its Outreach proposal: it planned to conduct an equity study in mathematics classrooms and have Arthur Powell of Rutgers University, who had addressed the collaborative at the 1988 UMC Annual Meeting, conduct a workshop on strategies for equity. Jo Helen Williams, UMC Standing Committee member and mathematics supervisor for the Dayton School District, one of the three replication sites, initiated action to see what relationships could be developed around the issue of equity between the UMC network and NCTM.

## Teacher Leadership and the Teacher Leadership Workshop

Teacher leadership gained greater attention during 1989-90 because of the work of TAP and the Outreach Project. The Teacher Leadership Workshop proved to be very successful in providing teachers with useful interpersonal skills and identifying teachers who were prepared to assume greater responsibility within the UMC network. The impact of the workshop was evident in the extent to which teachers became more confident in engaging and working with others and in taking more initiative for addressing issues. Teachers from this group were at the UMC Annual Meeting in Los Angeles, the first annual meeting with a sizeable group of teachers in attendance. TAP supported the attendance of one teacher leader from each collaborative. A panel with members selected from the workshop participants presented their perspective on equity in a session titled, "Bringing the Word Equity to Life." Eight teachers volunteered to serve on a committee to assist TAP in planning UMC activities at the NCTM Annual Meeting. A teacher leader from Philadelphia and TAP staff member, Grace Kelemanik, spoke about teacher leadership and professionalism at a New England mathematics teachers conference in October, 1989. The teacher leaders who had attended the workshop were active in their individual sites. It was these teachers who in many of the sites took the initiative or worked on preparing the proposal for the Outreach grants. As noted in the TAP's annual report to the Ford Foundation, ". . .an enthusiastic group of teachers is evolving into a viable network of teacher leaders. Our task in the next few years will be to provide the network a manageable set of motivating tasks through which it can become a stable arm of the UMC network." Clearly, the Teacher Leadership Workshop was a prominent factor in generating change during the year.

The Teacher Leadership Workshop sponsored by the UMC Technical Assistance and Outreach Projects was held August 6-11, 1989, at Lasell College in Newton, Massachusetts. The one-week workshop was planned to assist collaborative teachers with their work in leveraging change both inside the classroom and within the larger educational community. It was also designed to provide teachers with the skills that are necessary to participate effectively in negotiations over curriculum, fiscal concerns, and policy deliberations so that they become more effective negotiators, communicators, and decision-makers. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and the educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. At the workshop, teachers were given an opportunity to articulate their visions for their profession and for education. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC had agreed to sponsor two teachers from each collaborative to attend the workshop, paying for room, board, registration, and transportation. In total, 35 teachers representing all eleven of the original collaboratives participated in the workshop. The individual collaboratives covered expenses for the additional teachers who attended the workshop. In preparation for the workshop, the teachers from each collaborative were asked to identify an issue that was a problem in their collaborative. The workshop was run by Grady McGonagill, president of McGonagill and Associates, a consulting and management development firm. Other presenters included Maurice Sykes, director of Early Childhood Education and Leadership Development for the District of Columbia Public Schools; and Elizabeth Stage, executive director of the California Science Project and program director for the American Mathematics Project. Adam Urbanski, president of the Rochester Federation of Teachers in Rochester, New York, gave the opening address, an inspirational speech that focused on the power that teachers possess in education.

The sessions during the week focused on five major topics: Understanding Individual Differences, Interpersonal Skills, Power and Shared Leadership, Creating a Vision and

Building Support, and Negotiation. A teacher from the Twin Cities commented that the networking session caused him to realize that he had been creating his own network without even knowing it. In addressing the topic, Understanding Individual Differences, participants had the opportunity to review their individual practices in getting information, making decisions, focusing attention, and structuring their lives using the Myers-Briggs ™ Type Indicator (Briggs & Myers, 1988). The sessions on Interpersonal Skills taught the teachers how to deal with conflict and helped them to develop the art of active listening and self-assertion. To address Power and Shared Leadership, the teachers divided into three groups: Upper Management, Middle Management, and Workers. Each group was instructed to explore the meaning and use of power. The outcome of the simulation showed that some people took power without it being assigned to them, while others sat back and watched. Eventually the simulators broke into heterogenous groups containing Workers, Middle Management, and Upper Management, and each defined power within its group context. Creating a Vision and Building Support taught participants how to achieve goals by "looking into the future" and gaining support for ideas. Teachers were told that in order to visualize change, an individual must "envision" the setting that would follow that change. Participants in the Negotiation session discussed how to reach "wise agreement" with adversaries; the purpose was to show that compromise between adversaries was possible.

Nearly all of the teachers who attended the Teacher Leadership Workshop indicated that the experience was very valuable to them. The teachers became more accomplished in using interpersonal skills. Throughout the week participants practiced their listening skills, using active listening in their individual conversations and in their group interaction. Teachers also gained new knowledge of power structures and seemed to be more willing to engage those with power to accomplish goals. This was evidenced by the formation of one group of teachers to address ways of putting pressure on test publishers to change their policy of disallowing the use of calculators when taking norm-referenced standardized tests such as the SAT. In the process of addressing the issues the teachers applied some of the skills discussed during the workshop. They developed a clear statement of the group's goal. They then identified the organizations that could be used to exert pressures on the test companies to impel them to change their polices. Finally, the group identified those who have the power to change the prohibition against using calculators on tests. Universities and colleges were noted as being influential institutions that had to be addressed because of their use of SAT results. The ability of these teachers to identify a problem, specify the issues, and identify ways of solving the problem indicated that they had gained some basic understanding of the issues presented in the workshop on addressing power and making changes.

Another outcome was that individual teachers became more aware of how they could use some of the skills learned in the workshop in their daily interactions with co-workers. One teacher of 20 years worked on ways to better state her views to a very controlling department head. Toward the end of the school year she noted some of the benefits that she had gained from the leadership training experience, "I liked the activities and the interaction that they promoted. I came back in September gung-ho." She went on to note that the leadership workshop was one of the most important ways that the collaborative had enhanced her professional life, ". . . that has given me a chance to experiment with people skills, my own self-image and my awareness of who I am." Another teacher pointed to the value of the skills learned and the acquaintances made, "I felt the workshop was a great experience for two reasons. First, as a third-year teacher, I learned a great deal about leadership. Many of us have leadership skills that we do not realize we have. Secondly, I gained over 35 friends from all over the United States that I will never forget." Another indication of the value attributed to the workshop was the fact that teachers from two of the collaboratives, Los Angeles and Pittsburgh, took the lead in organizing a leadership workshop for teachers at their own sites. Workshop leader Grady McGonagill agreed to conduct these, in conjunction with local teachers and TAP and Outreach staff.

As a follow-up to the Teacher Leadership Workshop, the TAP supported one teacher leader from each collaborative site to attend the UMC Annual Meeting in Los Angeles. As part of the meeting, a panel of four teacher leaders spoke about inequities related to the area of curriculum, teaching strategies, staffing, and testing. The teacher leaders also met as a group to reflect on the differences the workshop had made on their professional lives and their plans for the future. Eight of the teacher leaders served on a committee to assist the TAP in planning UMC activities at the 1990 NCTM Annual Meeting. Many of the teacher leaders played key roles in their respective collaborative's response to the proposals for the Outreach Action Grant, and a teacher leader was added to the UMC Steering Committee.

A second Teacher Leadership Workshop was planned for August, 1990, for approximately 30 teachers. Three of the teachers who participated in the 1989 workshop will participate in the 1990 program to share their perspectives on leadership and networking. Each collaborative will be awarded a $1,000 grant to help support projects initiated by teacher leaders that involve teachers from two or more collaboratives.

## Communication

Effective and open communication was essential as the individual sites worked to establish a cohesive network of teacher collegiality and educational reform. The TAP promoted communication both among the individual sites and between the UMC project and the American Mathematics Project (AMP) and the Mathematics Education Reform (MER) Network. The Technical Assistance Project fostered communication in four important ways. First, key collaborative members from all fourteen sites, as well as mathematics professionals from higher education, business and industry, were brought together at a variety of meetings throughout the year. These included UMC-sponsored meetings of collaborative members at the 1990 NCTM Annual Meeting in Salt Lake City, the fifth UMC Annual Meeting in Los Angeles; and the two day-long meetings held for mathematics supervisors. In addition, the TAP capitalized on other national events to bring collaborative members together, including NCTM regional meetings, and the National Convocation of the Mathematical Sciences Education Board. Whenever possible, a special effort was made to create a bond among the 35 teacher leaders.

Second, the TAP fostered communication across sites by convening the UMC Standing Committee three times during 1989-90 to assist in the design and planning of the UMC Annual Meeting and to provide leadership on issues of importance to all collaboratives, including equity, mathematics reform, assessment, and teacher professionalism.

Third, the TAP worked to develop ties between the UMC network and other national organizations such as the American Mathematics Project (AMP) and the Mathematicians and Education Reform (MER) Network. As a result of these efforts, UMC again cosponsored a reception with AMP at the NCTM Annual Meeting, and mailing lists were shared among these professional organizations. Phil Daro, AMP director, also worked with the UMC mathematics supervisors at their May meeting in Washington, D.C., to outline a proposal seeking funds to develop assessment prototypes. Finally, EDC has continued to operate an electronic network. In October of 1989, the UMC switched from *Common Ground* to the *Bread Board System (TBBS) Bulletin Board* software, which can handle up to 32,000 messages organized into up to 63 separate message boards. In 1989-90, there were seven message boards in use--mailboxes (for private e-mail) and six public forums: Notices, Geometry, Assessment, Teacher Leaders, Algebra, and Outreach Action Grants. With the expanded capabilities of TBBS, users can send graphics as well as text over the system. The user base has expanded to include nearly 200 UMC members, including UMC directors, coordinators, and teachers, as well as noted experts in the field of mathematics reform. Representatives from nearly all of the collaborative sites are active participants in the electronic network.

## Urban Mathematics Collaborative Annual Meeting

The fifth UMC Annual Meeting was held October 18-21, 1989, in Los Angeles. Nearly 80 representatives from the fourteen Urban Mathematics Collaboratives attended, including project directors, coordinators, mathematics supervisors, and teachers, as well as members of the Technical Assistance, Outreach, and Documentation Projects, and representatives from EDC and the Ford Foundation. The 1989 Annual Meeting differed from previous meetings in two respects. First, teachers were an integral part of the conference, with EDC funding the attendance of one teacher who had gone to the UMC Teacher Leadership Workshop from each collaborative. In the past, the only teacher representatives who had been at the annual meetings were teachers who were invited in their role as either on-site observers or as collaborative coordinators. Second, whereas at previous annual meetings a variety of topics had been addressed, the 1989 Annual Meeting was planned as a working session on the single issue of equity. The theme of the meeting was "Everybody Counts: Strategies that Work." During the four-day period, collaborative members worked together to solidify their thinking on equity issues and to develop action plans to ensure that all students would have an equal opportunity to acquire the mathematics knowledge necessary for the 21st Century.

The Annual Meeting began with an informal reception on Wednesday evening. The gathering provided an opportunity for new and old collaborative members to spend time together and also to meet invited guests from the Los Angeles Unified School District (LAUSD).

Thursday's session opened with an address by Frank Holmes, the director of the minority engineering program at San Diego University and a member of the SDUMC Executive Committee, and Brian Lord of the Outreach Project in which they presented an overview of national equity issues. A panel discussion followed, focusing on Los Angeles' approach to equity and on methods of ensuring equity in mathematics education in Los Angeles, in light of the many roadblocks to change. The five panel participants included two high school principals, a representative from business, the director of the California Mathematics Council, and the director of the Achievement Council, a nonprofit organization established to provide leadership in raising the achievement level of African-American and Latino students. Toby Bornstein, the coordinator of the Los Angeles collaborative, moderated the discussion.

In the afternoon, Denise Cavanaugh of Hagan & Pierson, a Washington, D.C., consulting firm, presented a framework for group discussion and individual reflections on equity. Four teachers who had participated in the EDC Teacher Leadership Workshop continued the discussion by sharing their individual perspectives on equity. The teacher panel pointed out signs of inequity in the areas of curriculum, teaching strategies, staffing, and testing, and also presented some solutions, as well as ways to accomplish equity. Dr. Henry Gradillas, a special consultant to the California State Department of Education who works with the Effective Schools Program, was the keynote speaker at dinner Thursday evening. Dr. Gradillas gave an inspirational talk on the experience of working with Jaime Escalante at Garfield High School in East Los Angeles to create teaching practices and school policies to foster student learning. Gradillas warned the listeners, "Do not use any excuse as a reason to deny students equal access to education." He explained that student failure has very little to do with social-economic status and that an adjustment of teaching style is instrumental in changing the failure rate. He challenged the UMC members "to give students the opportunity to learn so that they have the opportunity to succeed."

On Friday morning, UMC participants visited mathematics classrooms to sample their diversity and to see the variety of strategies being used to facilitate all students' learning of mathematics. In the afternoon, the collaborative members worked with Denise Cavanaugh to develop action plans for equity at both the local and national levels.

On Saturday morning, the final day of the conference, the participants met as a single group to learn about the new UMC electronic network, *The Bread Board System*, and the increased capabilities it has for handling interactions among the collaboratives. Then each membership component--directors and coordinators, on-site observers, teacher leaders, and mathematics supervisors--met to address specific issues and concerns and to further develop strategies for finalizing their action plans.

## UMC Mathematics Supervisors Meetings

The UMC mathematics supervisors met for two day-long meetings in 1989-90. The major focus of the meetings was on assessment and on the preparation of a proposal to NSF for funding a project that would involve a number of the collaboratives in reforming assessment in their districts. The day before the UMC Annual Meeting, the group met to devise a plan of action. In preparation for that meeting, TAP sent to all of the supervisors materials that described some current assessment development projects, non-traditional examples of assessment tasks, and assessment materials from around the world. At the meeting, members of the group took time to review what was happening in each of their districts regarding assessment and continued to formulate ideas for reform. The discussion then turned to developing a common vision among the supervisors. Mark Driscoll outlined possible activities that could be planned by the group such as a miniconference on assessment. The group formulated a vision that grew out of changes recommended within the reform movement for norm-referenced standardized tests; other factors considered were the UMC's cohesiveness and the UMC's potential as a change agent. Each supervisor then suggested products that might emerge from a joint project. The group made a decision to generate a mission statement before the end of the UMC Annual Meeting.

It was apparent from this meeting that the supervisors themselves would like to learn more about assessment. In response to this, an informational meeting was planned for May in Washington, D.C. In preparation for this meeting, each mathematics supervisor was sent an assessment survey in February as a means of gathering information on how assessment was being used at his or her site and what the main assessment issues were. The results of the survey were the basis for discussion at the May meeting. On May 5, 1990, Phil Daro met with eleven of the mathematics supervisors and Grace Kelemanik to facilitate the process of defining the group's purpose and course of action. Phil Daro talked to the group about different forms of assessment. Then the supervisors were divided into two small groups, each with a particular planning task. Some time was spent during the meeting in having the group respond to a draft of the UMC assessment policy statement. One outcome of this meeting was that two of the supervisors were to meet with TAP staff to prepare a pre-application to be submitted to NSF. This was to be done during the summer of 1990. The group produced a general outline of a project that would have four phases: to communicate with teachers about assessment issues, to develop teams to draft and pilot items, to share the pilot items with the total group for field testing, and to disseminate the assessment tasks and other information that was generated.

## UMC Activities at the NCTM Annual Meeting

At the NCTM Annual Meeting in Salt Lake City, April 18-21, 1990, EDC sponsored three activities for members of the Urban Mathematics Collaborative project: an opening reception, and two working sessions with Manuel Fernandez which addressed equity and motivational issues. In addition, EDC hosted a breakfast meeting for UMC project directors and coordinators on Friday morning. The UMC Documentation Project hosted a dinner meeting for on-site observers on Friday evening and a Saturday morning working session.

On Wednesday evening April 18, from 5:00 to 7:30 p.m., EDC cosponsored a reception with the American Mathematics Project (AMP) at the Doubletree Hotel. Over 200 people, including representatives of all fourteen collaboratives as well as people associated with the AMP and their guests, attended.

The first UMC Working Session was held on Thursday from 5 p.m. to 9 p.m. Over 100 collaborative members gathered to hear Manuel Fernandez, the director of the METCO program for the Wayland Public Schools in Wayland, Massachusetts. METCO is a voluntary desegregation program that buses African-American and Hispanic students from Boston to suburban schools. In his address, "Enhancing the Potential of Students of Color through Staff Development," Mr. Fernandez shared his belief that the key to enhancing the potential of students lies in developing educators' own sense of efficacy--self-confidence, responsibility, and goals. He stressed, "As long as you're impeding your own development, you are impeding your students' development." He challenged the audience to try to meet the needs of all students, warning that ability grouping obstructs student development. He pointed out the importance of developing a relationship with each student, of reconditioning students to look at failures as an opportunity to learn and to grow, and of helping students pick goals that are challenging but realistic. During a group activity, he emphasized that educators need to work as coaches of student development and look at how each individual brings her or his special needs and talents to the classroom, emphasizing that the development of self-esteem is the key to success for all students regardless of their culture, race, or gender. Several of the participants commented that the discussion offered many interesting insights which they were eager to pursue during the session the following day. There was some concern that participants did not benefit from the session as much as they could have due to the lateness of the hour and the length of the session.

The follow-up session, which was held on Friday from 12:00 to 1:30 p.m., was limited to 25 participants so that there could be a greater exchange of ideas and a more in-depth discussion of plans that could be taken back to each of the collaborative sites. In this session, Manuel Fernandez talked about the logistics of designing a multicultural and gender-fair program and the importance of having both a plan of action and a support system. He also stressed involving the parents and the community in any program. He explained that in dealing with parents, as with students, we need to help them realize that they do have control.

EDC had encouraged collaborative members to apply to be on the program at the NCTM Annual Meeting. Four UMC members submitted successful program proposals. Ed D. Anderson, a teacher and member of the Governing Board of the Twin Cities Urban Mathematics Collaborative, presented a workshop that focused on introducing basic vector operations into high school geometry classes as well as on how to do transformations by means of matrices. Frank Holmes, director of the minority engineering program at San Diego State University and former co-coordinator of the San Diego Urban Mathematics Collaborative, presented a session in which he gave an overview of many of the problems facing ethnic and minority children in school and the ways in which the San Diego Mathematics Enrichment Project intervenes to help students. Joanne Meldon, a mathematics teacher who is an active member of the Pittsburgh Mathematics Collaborative, presented creative ways to work with estimation and mental mathematics in the high school classroom. Herbert A. Gesshel-Green, a teacher in the Philadelphia Math Science Collaborative, presented a session, Using the *Appleworks Spreadsheet* in Mathematics Class.

The responses to the NCTM Annual Meeting were extremely positive, with many collaborative teachers commenting that the conference not only presented them with an opportunity to hear excellent speakers and bring back new ideas to their classrooms, but that it gave them a chance to form bonds with teachers from the other collaborative sites.

## Governance

The Standing Committee, cochaired by Kimberly Sawyer of the New Orleans Mathematics Collaborative and Harvey Keynes of the Twin Cities Mathematics Collaborative, became more focused during 1989-90 on trying to verbalize common beliefs shared by all of the collaboratives. This group was formed in the previous year to work toward building common solutions to collaborative concerns. Over the course of the year, the group expanded its membership from six selected project directors and coordinators, a representative from the Documentation Project, and EDC staff, to a group of 10 including four collaborative directors (Kimberly Sawyer, Leslie Salmon-Cox, Harvey Keynes, and Peggy Funkhouser), three collaborative coordinators (Toby Bornstein, Nancy Gates, and Frank Holmes), one mathematics supervisor (Jo Helen Williams), one teacher (Jessie Cooper), and one documenter (Norman Webb). In addition, up to seven EDC staff members attended the meetings. To support the efforts of the Standing Committee, three working groups, each of which was charged with drafting policy statements on equity, assessment, and teacher professionalism, were formed.

The Standing Committee met three times in 1989-90. At the UMC Annual Meeting in Los Angeles, the group met with the project directors and coordinators. The directors and coordinators charged the committee with producing three working papers, one each on the topics of equity and mathematics program reform, assessment, and teacher professionalism. The directors and coordinators outlined a schedule that included: (1) forming working committees to prepare the drafts; (2) a review of the drafts by members of each of the collaboratives; and (3) finalizing the papers at the 1990 Annual Meeting in

St. Paul. The purposes of these policy papers were to help the UMC network develop a sense of mission and to have available in written form statements that could be shared with others to communicate what the UMC network stood for.

The second meeting of the Standing Committee was preceded by a one-day meeting of the three working groups on January 27 at the EDC offices in Newton, Massachusetts. EDC guided each of the working groups to specify their assumptions, issues/questions, and desirable outcomes/recommendations. Each working group was comprised of at least one collaborator director, one coordinator, and a teacher. The Equity and Mathematics Reform Working Group (Kimberly Sawyer, Harvey Keynes, Lise Dworkin, Jessie Cooper, Marieta Harris, Frank Holmes, Norman Webb, Mark Driscoll, and Pilar Olivo) generated ideas on the theme of better mathematics for all students. The working group also explored issues such as barriers to equity reform, changing people's beliefs about the potential success of underrepresented students in mathematics, and the need to generate new models for teacher enhancement that will lead to equity reform. The Teacher Professionalism Working Group (Toby Bornstein, Leslie Salmon-Cox, Keith Brown, Rodene Gosselin, Grace Kelemanik, and Janet Daisley) focused on three main sections of their position paper. In the professional component section, they addressed a code of ethics for teachers, roles, responsibilities, and networking. In the professional environment part, identification with a discipline, a career as compared to job, and self-reflection were addressed. Issues confronted in the leadership component were: keeping abreast of current knowledge in the field, practicing self-directed activities, meeting the needs of a diverse student population, the importance of membership in professional organizations, critiquing of oneself and other teachers, and assuming a comprehensive approach to professional leadership. The Assessment Working Group (Jo Helen Williams, Diane Briars, Joe Merlino, Barbara Patterson, Marty Gaslin, and Brian Lord) directed their attention to thinking about how assessment should be used, how it is now being used, who the main decision makers are, and the impediments to change that exist. This group decided to write a two-part position paper, one part on authentic/alternative assessment and one on factors affecting scores on tests. The assessment group had some difficulty becoming focused on what it wanted to do. The other two groups were better able to define their task, discuss and clarify the issues, and develop a timeline for completing a draft of their papers. At the close of the day, there was still some uncertainty as to the purpose for the position papers.

The Standing Committee met on January 28, 1990, at EDC offices in Newton, Massachusetts, following the meeting of the working groups. At its meeting, the Committee developed a tentative schedule for the preparation of the position papers as follows: the first draft was to be ready for the NCTM meeting in Salt Lake City in April; a second draft was to be sent to the collaboratives by May 15, with a June 30 deadline for responses from the collaboratives, and the final draft prepared for the UMC 1990 Annual Meeting, to be ready by September 1. Another major topic of discussion was the long-term governance of the network. The committee was told that beginning September 1, 1990, EDC would have funding for the ensuing two years. EDC administrators reported they were drafting a paper on their vision of EDC's role in the UMC network. They indicated the importance of meeting as a single group so that representatives of the individual collaboratives would have a sense of being part of a larger organization with the capacity to expand over a large area and to be self-sustaining. Some next steps were discussed regarding a means for linking the UMC network to other groups like MSEB and NCTM, the possibility of raising funds to support the network, and the possibility of supporting the network via contributions from the local collaboratives. The meeting concluded with planning for the EDC Annual Meeting in St. Paul. The group decided that equity was still an important issue that should be addressed at the St. Paul meeting. One suggestion was to have a series of workshops for teachers to demonstrate equity instruction.

Thirteen people attended the May 5, 1990 Standing Committee meeting held in conjunction with the MSEB National Convocation on making mathematics work for minorities--nine standing committee members and four members of the EDC staff. The meeting began with a presentation on UMC-related activities since the last Standing Committee meeting. The importance for internal networking was noted. The two cochairs of the committee had met with Myles Gordon, Brian Lord, Ken Hoffman of MSEB, and Barbara Scott Nelson for two hours at Ford Foundation offices in New York. The purpose of this meeting was to enable the UMC network to begin a dialogue with MSEB. Some participants took exception to Dr. Hoffman's references to "retooling" teachers. The UMC members felt that this term did not reflect UMC's vision of teacher leadership. In reporting on other activities, it was noted that Quality Education for Minorities (QEM), funded by the Carnegie Corporation, was considering holding town meetings in different communities. One QEM strategy for effecting change is to establish task forces in a number of communities--in several in which UMC is already active. Mark Driscoll gave a report on the CD ROM archive project, which is designed to archive mathematics education material and to educate people on the use of the technology. Leslie Salmon-Cox told the group that the QUASAR project was reviewing a final selection of field sites and would be making a decision some time in the summer. Kimberly Sawyer described the "Say Yes To A Youngster's Future" project that will be operating out of MAC in New Orleans. Frank Holmes gave the group an update on his NSF mathematics project which focuses on primary level students and teacher training.

In a discussion of the future of the UMC network, Myles Gordon commented on what the UMC network has to offer--a unique perspective, ideas and experience, operating entities, a mechanism for accessing teachers, and a mechanism for disseminating information. He reviewed the priorities that EDC identified for 1990-91: "To define what it means to talk to UMC," to address the governance issue, to clarify long-term support, to address the UMCs' role in developing teacher leadership, and to build connections within the UMC network and between the UMC network and other organizations. He noted the need to decide what collective action should be taken. Some of the questions facing EDC are: Should EDC sponsor a third Teacher Leadership Workshop? Should more replication sites be added to the network? Should technical assistance be continued for individual sites? Is there a need for restructuring the network?

The group discussed and identified potential issues such as the rate of change in education and society that will be experienced in the near future, the difficulties in bringing business people together with those in education, and the challenge of moving the UMC network from the margin of the system to the center so that the network can have an impact. It was decided that the cochairs and EDC would draft a document specifying a model for governance of the network. This draft was to be ready for review prior to the annual meeting so that action could be taken at that time. Standing Committee members were then told about some of the changes that will be made at the August 1990 Teacher Leadership Workshop. There will be more emphasis on networking than there was the previous year. More case studies will be integrated into the sessions--real case studies that come out of the school districts need to be introduced. Some members noted that teachers need to realize that they do have power.

The current drafts of the position papers were reviewed and discussed. The group felt that the papers should conform to a common format. For example, each paper should begin with an introduction communicating what UMC is. The committee felt that one more draft of each of the papers should be developed. These drafts were to be sent to the collaboratives prior to the October Annual Meeting of UMC representatives so that the papers could be discussed and approved at the meeting. The fall meeting then will be organized around the themes of the three position papers. Names of candidates both within and outside of the collaboratives who could give sessions on equity reform, assessment, or teacher professionalism were generated. The collaboratives were to be asked to send teams of people to the meeting--including the collaborative administrators, mathematics supervisors, two teachers, and a business representative. Guests from other organization such as MSEB, QEM, NSF, and NAEP would be invited.

The Technical Assistance and Outreach Projects convened the Standing Committee during the year and worked with the cochairs in planning its direction. The planning done over the year further established the governance structure for the UMC network. The TAP staff also worked with individual collaboratives to assist them in restructuring or making provision for changes in their local governance. In St. Louis, San Diego, Durham, and Memphis, TAP staff assisted the collaboratives in making basic changes in the host agency or in collaborative methods of operation. In the Twin Cities and Philadelphia, the TAP staff consulted with the collaborative administration in helping to identify possible adjustments in their governing structure.

## Outreach Project

The efforts of the UMC Outreach Project in 1989-90 were organized around four main objectives:

1. To build a middle level between policy and practice as a means of focusing UMC interests and highlighting UMC accomplishments, via Outreach Action Grants;

2. To continue programs in communications, media, and publicity;

3. To establish new urban mathematics collaboratives; and

4. To undertake new programs in policy and research.

## Outreach Action Grants

In addressing the linkage of the UMC network with the wider community of education reform, members of the Outreach Project observed that the accomplishments of the local collaboratives were too diverse to gain the attention of the larger community. Some mechanism needs to be introduced that would provide an incentive for the collaboratives to focus the thrust of their networks and activities in order to impact on policy. The strategy adopted by the Outreach Project to encourage the collaboratives to focus their potential for impact was to have them compete for Outreach Action Grants of $10,000. Five of the grants were to be awarded.

In order to compete for an Outreach Action Grant, the collaboratives were to submit a proposal for developing activities in one of three categories: teacher research, education policy, or networking. Priority consideration was given to restructuring, equity, staff development, and teacher leadership. The detailed Request-For-Proposal (RFP) was sent to the fourteen collaboratives in late November, 1989, with proposals due on January 30, 1990. Out of the fourteen collaboratives, eleven submitted proposals. These were read by eight reviewers who commented on the proposals and made recommendations on funding. In March, 1990, proposals from four collaboratives were given full grants--Cleveland, Columbus, New Orleans, and Pittsburgh. A fifth grant was divided between two collaboratives--Los Angeles and Memphis. Four of the six funded proposals were authored by teachers. The six projects proposed included one on designing and implementing alternative assessment, visiting other collaboratives and exchanging ideas, lobbying the district and state legislature, conducting a local teacher leadership workshop, the networking of mathematics teachers with teachers from humanities and science, and piloting an equity project.

## Communications, Media, and Publicity

During 1989-90, the Outreach Project produced three issues of the UMC newsletter, *<ANGLES>*. The June 1989 issue focused on the theme of equity. This issue included an article written by EDC staff on questions and strategies regarding the achievement of equity. Another article by Harvey Keynes and Lynn Steen was reprinted from the

*Minnesota Mathematics Mobilization Newsletter* on equity and excellence in mathematics education. And one column highlighted some equity programs. In the lead article of the January 1990 issue on restructuring, Janet Daisley and Brian Lord related current restructuring efforts in five areas--academic content, organizational reform, professional relationships, professional development, and assessment. Other articles described restructuring in the Rochester, New York, schools and how the New Orleans Mathematics Collaborative is nudging the state toward consideration of the reforms articulated in the NCTM *Curriculum and Evaluation Standards*.

The July 1990 issue focused on assessment. Jessica Richter in the article, "Assessment--Issues and New Approaches," clarified current assessment issues and concerns. Other assessment- related articles included an interview with Diane Briars, the Pittsburgh Public Schools director of mathematics, samples of new assessment developments, and excerpts from an article by Grant Wiggins on authentic testing. All three issues of <ANGLES> gave collaborative highlights from the fourteen collaboratives, reported on current UMC Network activities, and included an article by a collaborative teacher. In other efforts to publicize the collaboratives, staff from the Outreach Project helped local collaboratives arrange publicity in their communities and urged them to work with the replication sites to organize publicity for kick-off events.

Staff from the Outreach Project assumed responsibility for revising and editing the final drafts of the position papers being developed through the efforts of the Standing Committee. A draft of the Equity Reform paper was prepared prior to the NCTM Annual Meeting in Salt Lake City in April, 1990. The Outreach Project Staff collected feedback from the working group and prepared a draft for the May Standing Committee meeting. Editing and revision on the other two papers began after this meeting.

## Replication

With the addition of replication sites to the UMC Network by the fall of 1989, the Outreach Project staff organized and conducted replication tutorials at two of the three sites, Milwaukee and Columbus. Teachers and coordinators from existing collaboratives were identified to work alongside the leaders at the new sites as they developed their plans. Outreach Project staff arranged visits during which the collaborative guides spoke to their counterparts about the characteristics and prospective benefits of a mathematics collaborative.

In anticipation of funding one more replication site in the fall of 1990, the Outreach Project began preparing an RFP that will be widely disseminated to potential sites. The proposals received are to be reviewed by a select committee. A matching grant of $10,000 will be awarded to the successful applicant.

## Policy and Research

The Outreach Project and staff were active in working with and developing the UMC Standing Committee and its working groups. The Outreach Project also engaged in conversations with people from other organizations in an effort to establish a link between these organizations and the UMC network. Some of these are MSEB, NCTM, and QEM (Quality Education for Minorities Network). More work of this nature is to be done in the future. Work with the Teacher Networks Group (TNG) continued. The Outreach Project director began a study for this organization on the characteristics and financing of staff development in mathematics, science, and humanities in three urban school districts. Funded by the National Science Foundation and the Carnegie Corporation of New York, the study is designed to determine the extent to which a new model of staff development--the collegial model implicit in UMC programs--has been adopted more widely in the selected districts.

The staffs of the Outreach and Technical Assistance Projects jointly organized the first UMC Teacher Leadership Workshop in August, 1989. Over the school year the Outreach Project staff followed up on this experience and helped two collaboratives--Los Angeles and Twin Cities--organize their own shortened version of the leadership workshop. The Outreach Project and the Technical Assistance Project also worked together to plan the second Teacher Leadership Workshop in 1990. An important element of this workshop was generating a Teacher Leadership Network that will span the fourteen collaboratives. The $1,000 grants to be awarded to each collaborative for cross-collaborative teacher leader-initiated projects is one of the strategies for strengthening this network. It is hoped that the network will further the connections between the UMC network and the policy community. The teacher leaders are seen as important contributors in future efforts to strengthen mathematics departments and build school cultures responsive to new models of professional development.

The Outreach Project funded a team of researchers--Milbrey McLauglin, Stanford University, and Judith Warren Little, University of California, Berkeley--to assess the impact of the collaboratives on the professional lives and aspirations of mathematics teachers in two UMC sites. Interviews of teachers from these two California sites were conducted in May and June of 1990. The final report of this effort is to be completed in 1991 and an American Educational Research Association (AERA) presentation is planned at the Chicago meeting in April, 1991. In regard to this meeting, the Outreach project has arranged for ten UMC teachers to serve as reviewers of AERA proposals for sessions for Division C, Teaching and Learning in the Content Areas. This experience is seen as a necessary and valuable first step in involving teachers in research topics and the inquiry into teaching practice.

## Documentation Project

The 1989-90 school year marked the final year of formal data collection for the UMC Documentation Project. Data collected included: monthly reports and three sets of teacher interviews conducted by the on-site observers, a follow-up survey on teacher professionalism distributed to mathematics teachers at each of the eleven sites, a demographic survey sent to participating school districts within each site, and a total of 22 site visits, including a final site visit to each collaborative conducted by the staff of the Documentation Project. In addition to data collection, the Documentation Project published the UMC 1988-89 Annual Report, prepared a draft of the report analyzing the data from the Teachers' Conceptions of Mathematics and Mathematics Education Survey which had been collected during the 1988-89 school year, and completed the final five Case Studies in the series of eleven.

### Monthly Reports and Teacher Interviews

Each month the on-site observers submitted a Monthly Report Form that provided information on context and activities, as well as the on-site observer's general impressions of the impact of the collaborative. In addition, the on-site observers interviewed five different teachers in each of three months, September, February, and March. The majority of the questions in the fall interview related specifically to the impact of the collaborative on the teacher-interviewees. Questions covered its effect on teachers' perceptions of their role, the collaborative effect on their daily teaching practice, the extent to which the collaborative has impacted on teacher involvement in school-related decision-making practice, and the extent to which teacher awareness of current national trends in mathematics education has increased as a result of the collaborative. A final question asked teachers to identify significant changes that could be attributed to the collaborative. In February, the on-site observers interviewed teachers regarding their impressions of teacher leadership. Two of the five teachers interviewed at each site had attended the EDC Teacher Leadership Workshop in August, 1989. Topics addressed in the interviews included: perceptions of the teacher as a leader, how the collaborative has supported and encouraged teachers to assume leadership roles, how the collaborative has affected the teacher's own development of leadership qualities, and the qualities and accomplishments of teachers whom the teacher views as teacher leaders. The March interviews addressed issues related to teacher professionalism. The on-site observers were asked to interview five teachers who are either occasional or frequent participants in collaborative activities. Topics addressed during the interviews included: the role of mathematics organizations in improving mathematics instruction, the impact that mathematics teachers should have on determining the content taught in mathematics courses, the role that teachers should play in the evaluation of mathematics teachers, the contributions to society made by mathematics teachers, and how the collaborative has enhanced their views of themselves as professionals.

### The 1990 Administration of the Survey on Teacher Professionalism

The Survey on Teacher Professionalism was re-administered in 1990 to identify changes in teachers' views about teaching as a profession in comparison with the responses on the original administration of the survey in 1986-87. Six questions that addressed the impact of the collaborative were added to the follow-up survey. Copies of the survey were distributed in March and April of 1990 to teachers in all eleven collaboratives, and a total of 650 completed surveys were returned. A preliminary analysis of the data was prepared for distribution at the 1990 UMC Annual Meeting in October, 1990. The final report will be published during the 1990-91 school year.

### Demographic Survey

Twice during the five-year data collection period, the Documentation Project sent a Demographic Survey to collaborative school districts. The information from the two surveys provides background for the information that is reported by the on-site observers in the Context Diary of the Monthly Report. The survey that was distributed in June, 1990, requested information about the school district, including population data, budget information, school composition, teacher profiles, and data on the student population.

### Site Visits

Every year, members of the Documentation staff visited each site to meet with the collaborative's staff, to observe in classrooms, and to talk with teachers, district mathematics specialists, and district administrators. An effort was made to schedule site visits to coincide with collaborative activities so that the documenter could attend a collaborative event. One site visit to each collaborative was devoted to reviewing a draft of the 1988-89 annual report with the collaborative director or coordinator as a means of both verifying and validating the information in the reports. In addition to these routine site visits, the UMC Documentation staff made a final site visit to each of the collaboratives near the end of the 1989-90 school year. The visit was devoted to interviewing people who either had played a central role in the activities of the collaborative or had knowledge of the collaborative. Approximately a dozen people were interviewed at each site. Each person who was interviewed was asked to describe his or her involvement with the collaborative, the changes that had taken place because of the collaborative, the barriers to the development of the collaborative, what should have been done differently, and how the collaborative has impacted on mathematics education in the area. The information from the interviews will be incorporated into the five-year summary report that the Documentation Project is preparing for each site and in a book that will reflect on the entire UMC effort. The site reports and the book will be published in 1991.

## Special UMC Functions

In addition to the site visits, the documenters attended special functions related to the UMC project, including the UMC Annual Meeting in Los Angeles; working sessions and the project directors' and coordinators' breakfast at the NCTM Annual Meeting; the meetings for mathematics supervisors held in Los Angeles, October 18, 1989, and in Washington, D.C., May 5, 1990; and meetings of the UMC Steering Committee. Members of the Documentation Project also participated in one meeting with Barbara Scott Nelson and members of EDC at which the development of the individual collaboratives was reviewed and a plan for the future of the UMC network was discussed.

## Meetings of On-Site Observers

The Documentation Project used the UMC and the NCTM annual meetings as opportunities to meet with the eleven on-site observers to review and discuss plans for data collection. The on-site observers met on Saturday, October 21, on the last day of the UMC's 1989 Annual Meeting in Los Angeles. At the meeting, each on-site observer had the opportunity to share his or her impressions of the impact the collaborative has had in their districts. Data collection plans for the school year were reviewed, with extended discussion to develop the questions for the teacher interviews that were to address the topic of teacher leadership. The on-site observers had their second meeting of the 1989-90 school year on April 21, 1990, the last day of the NCTM Annual Meeting. At the meeting, each on-site observer shared his or her impressions of three important outcomes of the collaborative and three ways that the collaborative could improve, or particular challenges that the collaborative was facing. They also were asked to evaluate the Documentation Project, reporting any effect that the Documentation Project has had on the collaboratives as well as on how their role as a documenter affected them personally. Near the end of the meeting, the final plans for data collection were reviewed. On the evening preceding the meeting, the on-site observers held a farewell dinner to celebrate and to reflect on the five years of data collection, since their appointments as documenters were to terminate on July 1, 1990.

## 1988-89 Annual Report to the Ford Foundation

Each year, a major effort was expended in writing the annual report of the UMC project to the Ford Foundation. Preparation for the 1988-89 UMC annual report began in June, 1989; the report was published in March, 1990. The process of producing the report included synthesizing the information that had been entered into the data base, writing the summary reports, sharing the drafts of these with the collaborative leaders and on-site observers, and modifying the draft reports in response to each site's comments. After the revision and, in some cases, after repeated interactions with the collaborative, a final version of the report was prepared and then shared with the sites. Concurrently, the substantive evaluative part of the report was drafted and finalized. Nearly 200 copies of the report were distributed to members of each collaborative project as well as to a broader audience that included representatives from the business and industrial communities, school administrators, and scholars interested in the areas of teacher professionalism, collaboration, and the mathematics reform movement.

## Case Studies

The case study component of the Documentation Project was initiated in December, 1987, under the direction of Professor Thomas Popkewitz of the University of Wisconsin-Madison. The project was designed to conduct case studies involving one or two teachers at each of the eleven collaboratives, six during 1987-88, and five during 1988-89. During the 1989-90 school year, the reports of the last five case studies were shared with the sites and then finalized. The completed set of case studies, which represent the input of a variety of teachers whose professional lives have been affected by the UMC project, will be published in 1991.

## Summary

The Documentation Project will complete its contracted responsibilities in December 1991, with the publication of a book-length reflective analysis of the UMC project. At the conclusion of 1991, the Documentation Project will have produced six annual reports, including summary reports on each individual site; four technical reports based on data from large-sample surveys; a report summarizing the case studies in the eleven original sites; eleven final site reports summarizing the evolution of the project at each site from 1985 through June, 1990; a guide to documentation; and a final report to the Ford Foundation.

## IV. OBSERVATIONS AND REFLECTIONS

In this, the final UMC Annual Report to the Ford Foundation, the observations and reflections will encompass the span of the UMC project from 1984 to 1990, looking at some of the successes as well as some of the difficulties of the project. These observations do not constitute a thorough analysis of the project and of collaboration as an approach to reform. This task will be saved for the book that will represent a culmination of the efforts of the Documentation Project. What will be reported here are general observations on the development of each of the eleven original mathematics collaboratives, their efforts to achieve collaboration, and the resulting greater involvement of mathematics teachers in the teaching enterprise. The observation section at the end of the individual summary reports for each collaborative (presented in the appendixes) also offers reflections on each of the eleven original collaboratives. This section will draw from those reports and from information about the UMC network to make inferences about the project as a whole.

### The Background of the UMC Project

The UMC project was initiated to improve the professional lives of inner-city mathematics teachers. The ultimate expectation for the project was to improve the capacity of urban public schools to deliver an appropriate education to all students. Schools as community institutions have a responsibility to educate all youth for full participation in society. If schools can be changed to enable more students to complete a quality high school education that more adequately prepares them for continuing in education or assuming a role in the work force, then there is a potential that ultimately the effects of urban poverty on youths would be reduced. The UMC project is one of a series of Ford Foundation projects based on the premise that the improvement of inner-city schools goes beyond curriculum change and teacher upgrading, extending to the place of schools in the larger community and their overall effectiveness as institutions. Two other projects are the City High School Recognition Program, initiated in 1982, and the creation of the Public Education Funds in 1983.

Knowledge of mathematics is continually gaining importance as our technological society continues to develop and an increasing number of jobs require mathematical knowledge. Many states have increased their requirements for high school graduation to include a greater number of mathematics units. For example, Pennsylvania and Louisiana, two states with urban mathematics collaboratives, have raised their graduation requirement from two to three years of mathematics since the beginning of the UMC project. Because of the technological changes in society and the increasing importance mathematics is assuming in the work place, improving mathematics education in inner-city schools is a viable strategy for the reduction of urban poverty.

It is well documented that inner-cities are predominantly populated by those who are underrepresented in fields requiring some understanding of mathematics such as the sciences and engineering. By improving the quality of mathematics education in inner-city schools, there is a potential for making institutional changes that would result in inner-city youth becoming better prepared to meet society's demands. Critical to the process of change in the schools and in mathematics education are the teachers. Based on effective schools research available at the time of the project's conception (Ford Foundation Memorandum, September 7, 1988), students who achieve well in mathematics attend schools with (1) cohesive mathematics programs, (2) teachers who are knowledgeable about mathematics and about the specific content of mathematics-based occupations, and (3) teachers who assume that all students can and will do mathematics. Knowledgeable and enthusiastic teachers were seen as the key in effecting change. As a consequence, the goal of the Urban Mathematics Collaborative project was to strengthen the organizational and community structures within which mathematics teachers function in such a way as to improve their knowledge, resources, and support.

Rumblings in the mathematics education world were being felt in the early 1980s as the UMC project was being formulated. The need for new instructional materials was acknowledged, but was not expected for a number of years. Although in general agreement that change was needed, the mathematics education community in 1984 had not come to agreement on what change should be made. In this context and given the Ford Foundation's concern with strengthening the institution of teaching, the UMC project focused on creating a supportive and intellectually stimulating environment for mathematics teachers in inner-city schools and building links to regional and national mathematics education communities. The assumption was that in such an environment "teachers could improve their mathematical knowledge, feel more at ease with the subject, and develop a better sense for contemporary uses of mathematics." (Ford Foundation Memorandum, September 7, 1988)

In the project's conceptualization, there was an expectation that the collaboratives would address a number of issues. One of these was the isolation of teachers from each other, from others in their field, and from new developments in the content area. Another was the under-utilization of teachers within the district in solving educational problems. A third issue was the narrow notion teachers had of what was relevant to their profession and their lack of enthusiasm for teaching as a profession. A fourth problem was that teachers had little incentive to seek the up-to-date knowledge needed to actively participate in improving classroom practices, schools, and districts.

It was believed that increasing the professional experiences of teachers, raising their enthusiasm for their profession, increasing their up-to-date knowledge, and encouraging them to become more reflective regarding their teaching would have a positive effective on their classroom practice. Thus through collaboration, teachers were to be helped to articulate their problems, find solutions, and broaden their horizons. By these means, teachers would increase their potential to make significant changes that would lead to an improvement in instruction and that would motivate them to continue seeking positive changes.

At the beginning, the UMC project concentrated on mathematics teachers in inner-city high schools. The initial focus on mathematics teachers at the high school level does not suggest that mathematics education and teachers in the lower grades were less important. The high school level was chosen initially to narrow the scope of the challenge and to make it more manageable by specifying a clearly identifiable teacher group. High school mathematics teachers are a discrete, identifiable group to a greater extent than are those who teach mathematics in elementary and middle schools.

The project addressed several issues related to educational reform. One issue had to do with determining the conditions necessary for strengthening the profession of teaching.

> We hoped to illuminate the conditions under which teachers' need for time and resources to learn, think and plan could be defined and met; the conditions needed for the attainment of colleagueship; the conditions needed for the integration of new ideas and methods into the

> practice of teaching; and the amount and kind of resources needed to provide these enhancements of the profession as a standard part of doing the business of school. (Ford Foundation Memorandum, September 7, 1988)

A second issue was the viability of mathematics collaboratives as a means for reform. The project was conceived of as a means of identifying the mechanics for operating teacher networks, such as selecting a host agency, developing local resources, determining which teachers to target in a district, and tracking the pattern of change over time. A third issue to be addressed was that of determining conditions needed to ensure the continuation of both the whole project and its components.

The project monitor and the Ford Foundation adopted a strategy for identifying urban sites across the country, providing incentives in the form of funding a three to five-year period under general guidelines, and encouraging each site to develop its own model for collaboration. A conscious decision was made to select an organization outside the school district as funding agent and host responsible for setting up the collaborative. In some cases, the host agency was a Public Education Fund, also an initiative of the Ford Foundation. In other communities, individuals were consulted to determine the most appropriate organization to oversee collaboration in the area. A few communities were approached because of a particular characteristic or organization that would affect the form of the collaborative, thereby contributing to the experimental nature of the project. Not all communities initially approached were included in the project. Three cities received planning grants, but did not receive grants to continue the process.

## The Impact of the UMC Project

The primary goal of the UMC project was to enhance the professional lives of mathematics teachers in inner-city schools. A Ford Foundation report (1987) described the approach, "By fostering colleagueship among mathematicians and increasing the human and financial resources available to teachers, the projects [sought] to reduce teachers' isolation, to boost their professional enthusiasm, to enhance both their receptivity to new ideas and their capacity to discriminate among them, and to encourage resourcefulness in their teaching." In assessing the impact of the project in relation to its intent, it is important to consider the reduction in teacher isolation, enhanced professional enthusiasm, teacher awareness of and receptivity to new ideas, and the development of evaluation and critical reflection skills in teaching.

There are approximately 3,000 high school mathematics teachers in the eleven collaborative sites. Of these, about 600, or 20 percent, have become frequent participants in collaborative activities at their site. Another 1,100 or more teachers have participated in a collaborative in some way--that is, well over half of the mathematics teachers in participating districts have been reached by collaborative activities. Two of the collaboratives, Pittsburgh and Cleveland, have reached essentially all of the high school mathematics teachers in their respective districts. By the end of 1989-90 school year, nine of the eleven collaboratives had expanded their target audience to teachers of mathematics in middle schools. Two of the nine, San Francisco and Memphis, have included elementary teachers. In San Francisco, this move increased the collaborative's potential population from approximately 230 high school mathematics teachers to about 1,500 elementary, middle school, and high school teachers. Over 400 San Francisco teachers attended a spring mathematics conference sponsored by the collaborative. The estimated number of teachers who have directly participated in at least one collaborative-sponsored activity across all of the original collaborative sites approaches 2,000, including high school mathematics teachers, middle school mathematics teachers, and elementary teachers.

In addition to the fact that the collaborative has directly impacted on a number of teachers, at some sites these teachers are functioning as resources to other teachers. This creates a ripple effect that distributes the impact of the collaborative beyond those immediately involved. In New Orleans, the mathematics supervisor called upon collaborative teachers who had received professional development experiences through the collaborative to lead Title II--financed workshops presented for other district teachers. While information is not available on the full extent of these related effects, in terms of sheer numbers, the UMC project has been successful in reaching two-thirds of the potential number of high school mathematics teachers in collaborative districts.

Although determining the impact on students is not a focus of the documentation effort, it should be noted that the number of students who can be potentially reached by a single collaborative teacher magnifies the impact of the collaborative many fold. In some of the urban districts, mathematics teachers have over 150 students in classes over the course of a day. Thus, through the 2,000 teachers who have had some involvement in collaborative events, nearly a quarter of a million students are experiencing benefits of the teachers' collaborative involvement.

**The Reduction of Teacher Isolation**

From the beginning of the UMC project, teacher isolation was identified as a reality. Teachers generally knew only a small number of other teachers in their district. In some schools, teachers did not know all of the mathematics teachers in their own department. It could not be assumed that the mathematics department at a given school met regularly; in some schools, the only time teachers met each other was informally over the 20- or 30-minute lunch period. Many teachers had never attended a regional or national mathematics teachers' professional meeting. In some of the districts, teachers had never met, let alone had access to the mathematics supervisor; nor had they ever had contact with mathematicians in the business and higher education communities.

The problem of teacher isolation was perpetuated by several factors. One is that the structure of teaching in large urban school districts created barriers that made it difficult for teachers to interact with each other. The physical structure of large inner-city school buildings, the dispersion of mathematics teachers in all parts of the building, the lack of a department office or other central meeting place, and responsibility for monitoring the halls or cafeteria during non-classroom time all tend to prevent teachers from interacting with each other. Many of the school districts depended on one mathematics supervisor. Because of the physical size of the districts in terms of the number of teachers, number of students, and the distance among the schools, the mathematics supervisors relied more on sending written directives than on personal interaction with teachers.

A second factor contributing to teacher isolation relates to the nature of teaching. Teachers spend nearly all of their professional time with their students. The results of the Survey on Teacher Professionalism administered in 1986 to 576 collaborative teachers indicated that an important reason why collaborative teachers became teachers was because they enjoyed being with students. Having to provide instruction for 100 to 150 or more students each day compels teachers to focus their efforts on their responsibilities to their students. This leaves little time and energy for doing much else. The demands of teaching--remaining alert to the needs of the individual students, maintaining order, and being physically active nearly all day--are exhausting. Because of the very nature of teaching, teachers tend to direct less attention to other teachers and spend most of their time oriented to students.

A third factor contributing to teacher isolation is the absence of a sense of professionalism. Many teachers do not seem to feel a responsibility to the profession as a whole, nor do they believe that the time and energy spent participating in a professional group is worth the effort.

The variety of approaches to collaboration that have been implemented have to some extent reduced teacher isolation in each of the collaborative sites. One important change has been the development of new relationships between the mathematics supervisors and teachers. This has taken place in most of the collaboratives, although not in all. The greatest interaction between the teachers and mathematics supervisors has occurred in districts in which the collaborative has actively involved the supervisors in the planning process and has been sensitive to the importance of building upon the supervisor's program. The collaboratives have developed into active support systems for supervisors, which in turn has resulted in supervisors turning more to teachers for input. In these districts, the interaction with the mathematics supervisors led to groups of teachers becoming more active in the district's mathematics education program.

In Cleveland, for example, the mathematics supervisor now works with several groups of teachers to further the mathematics program in the public schools. The supervisor depends upon the teachers to provide resources for programs such as the Mathematics Teachers' Resource Center, the problem-solving bulletin board, the Problem-Solving Infusion Project, and a calculator project.

In Pittsburgh, monthly meetings between the Instructional Teacher Leaders and the district's mathematics director have resulted in an on-going dialogue. In Los Angeles, while the mathematics supervisor was not very involved at the beginning of the collaborative, he has since become active. When he formed a district mathematics committee, he included mathematics teachers who had come to his attention through the collaborative.

In some districts, systemic changes were made that provided collaborative teachers with special privileges. For example, the Memphis Public Schools has given collaborative teachers additional release days to engage in professional activities. It is clear that the UMC project has effected change by reducing teacher isolation through the establishment of a stronger relationship between mathematics supervisors and the teachers and through including teachers more in the curriculum decision-making process.

Changes have not been as evident when the mathematics supervisors or the district have not been an integral part of the process. In Durham, for example, the mathematics supervisors have been kept informed, but have not taken an active role in the planning process. In the Twin Cities, the mathematics supervisors have been active, but the districts have demonstrated only limited support for the collaborative. As a consequence, there has not been any structural change in these districts. In fact, in one district the mathematics supervisor's time was reduced to 60 percent.

A second factor that has acted to reduce teacher isolation is the collaboratives' efforts to develop an expanded notion of professionalism. The collaboratives have given teachers greater access to professional experiences by providing professional development grants, informing them of available opportunities, enabling them to meet with professional groups outside their schools and districts, and providing opportunities for them to be workshop leaders. For some teachers, interaction with a larger professional community and their heightened awareness that they share a professional commitment with colleagues across the nation has helped to renew their interest in teaching. For teachers in New Orleans who attended the 1989 UMC Teacher Leadership Workshop in Newton, Massachusetts, the recognition of what teachers in other collaboratives were accomplishing provided the impetus to make changes in their own district. When they returned to New Orleans, they initiated the restructuring of their Teachers' Council into the Leadership Council and began developing strategies for influencing policy decisions. As a result, a collaborative teacher presented the Leadership Council's position at a school board meeting on an issue that was in opposition to what the district administration was supporting. In Cleveland, mathematics teachers are now chartering a bus to attend the annual meeting of the state mathematics teachers, whereas previously only a handful had attended. Through increasing teachers' involvement in professional meetings and activities, the UMC has expanded the reference group from which teachers can receive both information and support.

In some schools the mathematics department has become a cohesive group meeting regularly. But this is certainly not true in all districts or high schools. Some collaboratives have developed specific incentives to encourage mathematics departments to become more functional and to increase teacher interaction. This has been most apparent in Los Angeles in its new departmental planning process, in San Francisco where the collaborative implemented an adaptation of Los Angeles departmental model, in San Diego where collaborative administrators initiated departmental meetings, and in Cleveland through the Model Mathematics Project. As one Los Angeles teacher reported, "Our department is now beginning to focus together on problems. The process is slow but teachers are becoming less isolated."

The collaborative coordinator for New Orleans--a collaborative that did not focus on departmental change--noted that this was one element of their program that could have been improved. Individual teachers in New Orleans have become involved in collaborative activities, but the departmental units essentially remain unchanged. Within the same school there will be teachers who are very active in the collaborative and others who have very little awareness of the collaborative. In a few instances, pairs or small groups of teachers within a school have been motivated by collaborative experiences to work more cooperatively with each other in their teaching. While in these schools departmental dynamics may have remained the same, teachers are now working together to use computer software with their students and to plan instruction for their classes. The collaborative has influenced changes in the functioning of a department when department dynamics have been a direct focus of the collaborative. When this has not been the case, teachers have forged their own working relationships, even though the departmental dynamics remained untouched.

A key factor in the reduction of teacher isolation has been the expansion of teacher networks. Prior to the advent of the collaboratives, district mathematics teachers had little opportunity to get to know each other. While many school districts had all-district inservices the week before the school year began, and some held a mid-year inservice, teachers had a tendency to sit with others they already knew. All of the collaboratives initiated gatherings for mathematics teachers that, at least in part, were designed to acquaint mathematics teachers with other mathematics teachers. Through these functions, teachers began to identify with the large group of district mathematics teachers. Most of these large group gatherings had other than purely social purposes; in San Francisco, for example, teachers heard a nobel laureate speak and in St. Louis, foreign educators presented programs on mathematics education in their countries. The socialization function that the collaboratives have served has been important. A business associate active in the Cleveland collaborative felt that informal gatherings were crucial because people get to know each other in informal settings more readily than in meetings. The collaboratives also have been able to provide amenities, such as refreshments for meetings, that districts are often prohibited from doing. For some collaboratives, in fact, refreshments have become a trademark. In Pittsburgh, teachers know that it is a collaborative event when refreshments are served.

Many collaboratives, especially in the initial years, made networking a primary objective. The Durham Mathematics Council held five or six meetings during the school year for teachers who were teaching a particular course. During the development stages of the Philadelphia collaborative, the coordinator viewed herself as an in-school collaborator who could link together teachers who had common needs. Through socializing, networking, working together on projects, and other professional experiences, mathematics teachers began to draw on each other as resources to a greater extent than they did before the collaborative. In addition, they are beginning to feel more confident in their teaching. As teachers have gotten to know each other and have the opportunity to communicate and share with their peers, some have become more confident and more willing to try new approaches, such as cooperative learning, in their classrooms. Teachers have indicated that before the existence of the collaborative, they did not know whether what they were doing in class had validity. In talking with other teachers, they have received reinforcement for what they do and the support to make changes. A middle school teacher from St. Paul who has been a frequent collaborative participant put it this way, "I do not feel alone in this job as I have at some times in the past. I use many more innovative ideas [in my daily teaching] and try more new methods that I acquired either from collaborative members or at collaborative sponsored talks and workshops." A frequent collaborative participant from Cleveland noted that one of the most significant changes attributed to the collaborative has been creating "a feeling of togetherness and sharing among the math teachers in our district." A Memphis teacher reflected on the impact of the collaborative, "Personally the most significant change I attribute to the collaborative is that when I step into my classroom, I do not feel alone. I am more keenly aware, than ever before, that there are many others doing what I am doing. . . .Most importantly--if I feel the need for assistance I have a much larger network of mathematics teachers that I may call upon." Comments such as these are made by teachers in each of the collaboratives, indicating that all of the collaboratives have brought mathematics teachers together in ways they have not experienced before.

Teacher isolation is being reduced through the collaboratives and the larger UMC organization as a result of teachers forging new and stronger relations with those in their school, their district, and across the nation. The collaboratives also have had some success in reducing the gap in understanding between mathematics teachers and those in business and higher education. Collaboratives have sponsored many events that have included teachers and representatives from business and higher education, and over half of the collaboratives have organized site visits for teachers to enable them to experience the business or corporate workplace. Nearly half of the collaboratives have organized summer internships, or have been associated with an internship program that provided summer opportunities for mathematics teachers to work in businesses. All of the collaboratives have business representatives and higher educators serving on advisory boards. In Cleveland, Memphis, Philadelphia, San Diego, San Francisco, and Twin Cities faculty from local colleges and universities have served as valuable resources in giving workshops and institutes.

A few collaboratives have been able to develop more unique relationships among business, higher education, and teachers. In Cleveland, where there has been a history of strong business support in the community, business and higher education members of the collaborative's Advisory Board formed the Advocacy Committee. This group actively developed and put into operation a model mathematics project to support mathematics departments in creating innovative mathematics programs aligned with the principles of the NCTM *Curriculum and Evaluation Standards*. The concept of advocacy, as demonstrated in Cleveland, has led to a mature state of collaboration that extends across the sectors. Through the Advocacy Committee, people from business and higher education have become much more knowledgeable about the condition of teaching in inner city schools. Cleveland teachers have a strong sense of the support of those in business and higher education. In this environment, the Cleveland Public Education Fund has been successful in obtaining NSF funding to encourage innovation by mathematics departments. The efforts by business community members to develop a plan to support mathematics education in the public schools have not been as prominent in other collaboratives. The collaborative had set the stage for this level of support, however, because throughout the history of the collaborative, the district mathematics supervisor and the teachers had kept the Advisory Board informed of new innovations in mathematics education, including the principles of the NCTM *Curriculum and Evaluation Standards*. The Cleveland advocacy model has not evolved in any other collaborative. In other collaboratives, support from business and higher education generally has taken the form of financial contributions or the commitment of someone's time to a certain function or activity. However, in every case of business sector involvement, one principle was clear: if business and higher education are to be committed and willing to give their time, they need to feel that what they are doing is meaningful.

The UMC project has also generated other forms of cross-sector collaboration. In Los Angeles, for example, a team made up of a teacher, a business representative, and a chemistry professor developed and gave a four-part workshop for mathematics teachers as part of the collaborative's +PLUS+ workshop series. Each member of this team contributed his or her expertise to the benefit of other teachers who took the workshop. The professor contributed conceptual understanding of mathematics in the world of science; the engineer presented practical models for applying the ideas; and the teacher distilled these ideas so they would be understandable to high school students. Only one +PLUS+ workshop was developed by a team that depended so strongly on individual commitment by the team members. A key factor in the formation of this team is that the teacher asked the university professor to become involved. Because the request came from the teacher, the professor, already over-committed, was willing to participate.

Both the Advocacy Committee in Cleveland and the Los Angeles triad have brought together talents from each sector, more or less on an equal level, to achieve specified goals. Other collaboratives have generated business and higher education involvement by inviting representatives from these sectors to serve on advisory boards, sponsor site visits, mentor an intern, or give presentations. These, however, are more passive forms of collaboration; while they do not lead to structural changes, they do contribute to the exchange of information among the sectors and signify the commitment of the business and higher education communities to the support of teachers.

While the collaboratives have made inroads in initiating communication between teachers and members of the business and higher education communities, nearly all of the collaboratives over the five years of their existence have focused more on the development of interaction among teachers than on communication between teachers and those from business or higher education. One reason for this is that teachers have not always felt that interaction with those in business or higher education is productive. For example, while the site-visit experience has given teachers information that has proven useful in explaining why students should study mathematics, teachers have been less apt to use the information to structure classroom experiences for their students. In preparing for site visits, representatives in industry have had difficulty communicating about the mathematics they use in their work at a level meaningful to teachers. As noted above, successful interactions of this sort require cooperative efforts from all groups in pursuing a common goal. In New Orleans, the collaborative coordinator met with business people prior to the site visit to clarify expectations. And in Cleveland, teachers provided feedback that enabled the company to generate a book of work-related problems for use in the classroom.

Teachers have valued the workshops and institutes sponsored and/or funded by the collaboratives. At first, most of these were presented by representatives from higher education. As the collaboratives have matured, however, a greater number of professional development experiences are being led by teachers. This is an indication that teachers are assuming greater responsibility for providing resources to other teachers.

## The Enhancement of Professional Enthusiasm

The collaboratives have increased the enthusiasm teachers have for their profession. On the Survey on Teacher Professionalism that was administered in 1990 to teachers in the eleven original collaboratives, 81 percent (489 of 601 respondents) of the frequent or occasional collaborative participants agreed that the collaborative "had enhanced the professional lives of mathematics teachers." A larger proportion of those who were active than of those who were only occasional participants in the collaboratives strongly agreed that the collaborative had enhanced their professional lives; 42 percent of the frequent participants strongly agreed, whereas only 16 percent of the occasional participants did.

A high percentage of collaborative participants, 69 percent, also indicated that the collaborative has expanded their notion of what it means to be a mathematics teacher. Those who have been most active in the collaborative feel stronger about this effect than do only marginal participants. One third of the frequent participants, compared to 9 percent of the occasional participants who responded to the questionnaire, strongly agreed that the collaborative was responsible for expanding their perception of their profession.

A number of teachers have indicated that the reason they have remained in teaching was because of the collaborative. By gaining a support group and getting more involved in mathematics-related activities, these teachers have increased their enthusiasm for teaching in ways that have helped them to transcend the many demands placed on them by their students and the administration. An active collaborative teacher put it this way, "The most significant change in my professional career that can be attributed in part to the collaborative is my desire to continue to teach. Because of the positive experiences I have encountered, teaching became fresh to me again." Some teachers feel that through their collaborative they have become more valued both as teachers and as decisionmakers. This feeling of importance has helped to increase teachers' enthusiasm for what they do. A Pittsburgh teacher reports that the Pittsburgh Mathematics Collaborative has had a major effect on his perception of teaching, "I have found that my attitude has improved about the decision making of curriculum items in mathematics. I am more [inclined] to work at curriculum items because my role as a teacher has important influence in curriculum changes."

Collaborative teachers continue to report the value of networking with other teachers and the support they gain from such interaction. This collegiality is a major factor in increasing their enthusiasm for teaching. The UMC project has heightened the enthusiasm of mathematics teachers for their own teaching and for their profession. Teachers have gained a renewed sense of being valued by the larger community; they have access to the state-of-the-art ideas in mathematics education; and are being supported by others. Not all of mathematics teachers in the targeted districts have been reached by the collaboratives, but an estimated two-thirds of them have. On the basis of the responses to the questionnaires and teacher interviews, it is reasonable to include that those who have been reached have been positively affected.

**Teacher Awareness of and Receptivity to New Ideas**

The UMC project has been instrumental in bringing the national agenda for mathematics education into inner-city districts. This has been achieved by granting teachers funds to attend national meetings, bringing in nationally known speakers, informing teachers of professional opportunities, and conducting workshops on the most current national trends. The collaboratives have generated highly motivated groups of teachers who have been able to take advantage of and build upon the momentum created by the release of the NCTM *Curriculum and Evaluation Standards*. A Philadelphia teacher, for example, admitted that because of the collaborative, "I paid special attention to the NCTM *Standards* which I would have otherwise ignored."

A teacher active in the Durham Mathematics Council responded to a question about how the collaborative has increased teacher awareness of the current trends in mathematics education; "We have really studied the *Standards* and tried to implement them. DMC has widened my knowledge of some mathematics areas that I'd not heard of before despite my bachelor's and master's degrees in the field." Other DMC teachers reported learning more about discrete and finite mathematics.

By taking advantage of professional development grants financed through the collaborative, many of the collaborative teachers have attended national meetings and other professional events. Supported by their collaborative, a number of teachers have attended an NCTM annual meeting for the first time. A St. Louis teacher noted the wide experiences that the collaborative has provided, "[I am] more motivated to keep up. I have seen Irwin Hoffman, Jan de Lange, Marilyn Burns, [an] EQUALS Program [presentation], Tom O'Brien, Zal Usiskin, Uri Treisman, Jane Martin and [attended a] Woodrow Wilson Institute. There were just not these choices before the collaborative."

Collaboratives have been successful in helping teachers make sense of the wealth of information and materials that are now available to them. Through workshops, institutes, and publications, the collaboratives have made teachers aware of new materials, methods, and technologies and helped them to set priorities as they face the challenge of mathematics reform. As one Durham Mathematics Council teacher reported, "I have a much better sense of what is important from our workshops and network meetings. DMC is on the cutting edge of mathematics, changes in instruction, and equity. DMC critiques for us and helps separate the wheat from the chaff." In this sense the collaboratives have provided leadership in mathematics reform by helping teachers to sort through the voluminous amount of information to find what can be useful to them. Assisting teachers in this way has been particularly characteristic of those collaboratives associated with an institution that is itself doing work in mathematics education reform: the Durham Mathematics Council in its association with the North Carolina School of Science and Mathematics; the San Diego Urban Mathematics Collaborative and its association with the Center for Research in Mathematics and Science Education; the Twin Cities Urban Mathematics Collaborative and its association with the University of Minnesota and colleges in the area; and the Cleveland Collaborative for Mathematics Education and its association with various local universities.

All of the collaboratives have provided teachers with experience in using technology such as computers, software packages, and graphing calculators in their classrooms. For example, the Philadelphia collaborative, in cooperation with the district, has established a technology conference that has become a yearly event. At this conference, teachers demonstrate to their colleagues how to use certain software or calculators. The participants have time to practice using the equipment, then they take materials back to their classrooms to use with their students.

The UMC project has been responsible for some teachers using computers in their classes more extensively. Some of the collaboratives were instrumental in circumventing the bureaucracy so that teachers could obtain computers for use in their classrooms. It appears that having someone from outside the district request the insulation of a telephone line to hook up a modem, or to get a computer out of storage and into a teacher's classroom, has greatly facilitated the process. One Memphis teacher learned more about using computers with her pre-calculus class when she attended a summer conference in Durham, partially sponsored through UMC. Upon returning to Memphis, the collaborative coordinator helped her circumvent part of the procurement process in order for the district to provide a computer for the teacher's classroom. Her students became so accomplished in using the computer that the students were giving demonstrations to teachers at conferences on the applications of software.

Many of the teachers who have become active in the collaboratives have responded positively to the introduction of new ideas. A number of teachers have made major changes as the result of encountering new approaches with only minimal encouragement. Two St. Paul teachers, after hearing a talk by Uri Treisman, began to restructure their geometry course to encourage students to turn to one another for help in order to facilitate student-student interaction. Students were also encouraged to ask other teachers, rather than only their classroom teacher, for help, so that they will become accustomed to using a variety of resources and will become less dependent on a single authority. A teacher in the Los Angeles area received support from his department head to teach one period of geometry without a textbook. The encouragement he received and the ideas that he built upon came from a variety of sources, the collaborative being one. The collaborative created an environment in which this teacher was empowered to make a change. Throughout the year, he received encouragement and ideas from teachers and others in the larger UMC network over the electronic network.

In some collaboratives, systemic changes are evident through new courses being offered in the district curriculum or the formation of groups of teachers making decisions about the district curriculum. Teachers in Memphis developed a course for students to take during their senior year that is an alternative to taking AP Calculus. In Los Angeles, a teacher is trying to persuade the district to institute a finite mathematics course that students could take instead of AP Calculus. In Pittsburgh, a problem-solving course aligned with the NCTM *Curriculum and Evaluation Standards* has replaced the traditional 9th-grade general mathematics course. A Mathematics-In-Applications course that is technology-driven is being offered in Philadelphia as a third-year of mathematics to help students fulfill the state graduation requirement of three years of mathematics. The collaborative was instrumental in distributing software among teachers and helping them plan the course.

Collaborative teachers report that indeed the collaborative has made a difference in how they teach mathematics. In the Diary of Professional Relationships, the on-site observer in each collaborative asked five or more teachers to indicate what effect the collaborative had on their daily teaching. All but two or three of the teachers reported that the collaborative had had some impact on what they do in their classes. A large percentage of them reported being more willing to take risks--a result they attributed to the ideas exchanged in the interaction with other teachers through collaborative activities and to the fact that they have support for trying something new. A junior high school teacher active in the Twin Cities collaborative noted some effects on the collaborative on her daily teaching, "I do not feel alone in this job as I have at some times in the past. I use many more innovative ideas and try more new methods that I acquired either from other collaborative members or at collaborative-sponsored talks and workshops." A Cleveland teacher noted the most significant changes attributed to C$^2$ME, "Very simply, I have become a risk taker in the classroom. From a professional standpoint, I feel appreciated for the first time. The collaborative has helped create a feeling of togetherness and sharing among the math teachers in our district. This can have only a positive effect on our students." A teacher from San Francisco reported that she was more willing to take risks. As one result, she no longer feels compelled to follow a textbook. "I guess I attribute that largely to our experience at the Exploratorium," she reported. "It took a long time for me to integrate that into my daily teaching, but I learned from it that everything need not be presented in a book."

Many of the nearly 60 teachers interviewed across the collaboratives felt they were being more innovative in using ideas that they had been exposed to as a result of attending collaborative-sponsored events. Others noted the use of technology as the biggest change in their classes. A few were using manipulatives and cooperative learning more with their students. A junior high school teacher in Cleveland is now using manipulatives and scientific calculators for the first time, resulting in a dramatic change in teaching and learning in the classroom. Another Cleveland teacher has experienced similar changes, "Not just in part, but my whole way of 'being' as a teacher has turned around. I am open to piloting new trends in the classroom, i.e., calculators, problem solving, and manipulatives. I am not at all tied to going page by page through a math textbook and my students are enthused and involved in their math lessons."

Many other stories of teacher interventions could be related. It is very evident that the UMC experience has increased teacher awareness of the current trends in mathematics education. This, linked with the support from their peers, has given teachers the confidence and the knowledge to make changes. For some teachers, the collaborative experience has affirmed what they have been doing, giving them more confidence in themselves and greater assurance that their students are receiving the instruction that will prepare them for a changing world.

## The Development of Evaluation and Critical Reflection Skills in Teaching

All of the collaboratives have provided opportunities for teachers to gain new information and to share ideas with each other. Rarely, however, have these experiences resulted in teachers identifying both the positive and negative aspects of ideas shared, or in offering constructive feedback for making improvements. Because the conditions of teaching do not offer teachers the opportunity to reflect critically on what they or other mathematics teachers are doing, it has taken a concerted effort for a collaborative to be able to address this issue.

In Pittsburgh, in cooperation with the district's department of mathematics, teachers have been encouraged to pilot ideas so that curriculum decisions can be made on the basis of data and experience rather than on opinion alone. When selecting an algebra textbook for the district, a small experiment was conducted using three different books. Student test results were one source of information used to distinguish the effectiveness of each of the textbooks. The environment in Pittsburgh encouraged two teachers to make changes in their geometry course as a result of their attendance at a one-week Woodrow Wilson Summer Institute in Geometry. These teachers sought and received permission to pilot a new textbook. The next year other teachers were included in the pilot. The collaborative in Pittsburgh has helped to establish an environment that encourages teachers to pilot new ideas and to gather information on how these ideas work so that rational changes in the system can be implemented. The director of mathematics has been a key person in creating this environment.

There have been numerous instances in the UMC network of teachers piloting new materials--for example, that of Twin Cities teachers who had attended the University of Minnesota Summer Institutes who implemented their ideas during the school year. And teachers in each of the collaboratives have been asked to use materials developed at the North Carolina School of Science and Mathematics. But there have been some missed opportunities, such as when teachers have shared teaching ideas in workshops or conferences without any open discussion of their merits and difficulties. In these situations, most often ideas are accepted at face value with little or no consideration given to whether implementing the idea will further develop students' knowledge of mathematics or help them relate their knowledge of mathematics to other experiences.

Only a few of the collaboratives have held events oriented to encouraging teachers to reflect critically on teaching, on the curriculum, or on some other aspect of teaching. For this to happen, it seems necessary that the collaborative coordinator or director be a driving force. In Los Angeles, the collaborative director helped resolve certain systemic problems so that teachers could leave school during the day to visit another school and observe another teacher presenting a lesson. Time for the teachers to discuss what they saw was also built into this experience. Sometimes the lesson was videotaped so teachers could share the experience with other teachers in their schools. Throughout the existence of the collaborative in Los Angeles, the importance of reflecting on what has been done and defining ways to make improvements has been stressed. After each of the +PLUS+ workshop sessions, the presenters gathered over lunch to evaluate the day's sessions and to talk about improvements needed. One component of the +PLUS+ departmental planning process has been to design an evaluation component that will determine what goals and objectives were achieved. Even given this constant concern on the part of the +PLUS+ director to reflect on what was done, teachers have difficulty being reflective and critical about their own teaching and the teaching of others.

In general, teachers have resisted the idea of reflecting critically on instruction, particularly on what others do. One reason for this resistance may be that teachers are constantly striving to give positive and supportive feedback to their students. Another is that teachers have not been trained to be critical in a positive way. When teachers talk with other teachers, they tend to want to support the teacher rather than be critical in any way. Routinely, when a collaborative has sponsored an experience for teachers to share ideas with each other, the interaction among the teachers has focused on explaining the ideas without anyone discussing how they might be improved, what difficulties they present, and critically evaluating how they might serve to increase students' knowledge of mathematics. In general, the collaboratives have neither generated the conditions nor provided activities that help teachers (1) build the skills to reflect productively on their and other's teaching and (2) offer productive criticism. Finally, within the hierarchical organizational structures of teacher assessment, peer critique is seen as threatening and in conflict with the development of collegiality.

## Summary

In summary, the UMC project has had a positive impact on reducing teacher isolation, as well as increasing professional enthusiasm and enhancing teacher awareness and receptivity to new ideas. The collaboratives have not realized the same effect on the development of teacher evaluation and critical reflection skills.

The greatest response and support still has come about with teachers helping other teachers. This has happened in an environment where those from business, higher education, and the district administration have contributed resources and encouragement. The project has increased the awareness on the part of people in business and higher education of the commitment of teachers and their enthusiasm for what they do, although other sectors still do not comprehend fully what teachers face daily. The gap between the different sectors seems to be due to the lack of a common language for talking about the problems teachers face and the defensiveness teachers display about reflecting critically on what they are doing. There also has been some hesitancy by those from the business sector to voice their full opinions or to offer productive suggestions because they have not felt fully a part of the collaborative process and did not want to offend teachers. Within the district structure, the collaboratives have made mathematics teachers and mathematics education more visible to the administrators. In some sites, the mathematics collaborative is providing the model for content area development. Interaction between teachers and mathematics supervisors has been increased, with some supervisors viewing the collaborative teachers as the ones to turn to when help is needed. As the UMC project has evolved, it has generated an expanded notion of collaboration that has gone beyond individual sites and is now emerging as a cooperative national effort.

In the remainder of this chapter, we will address the four areas of project management, collaboration, professionalism, and mathematics focus, which have formed the basis for organizing the individual summary report for each of the collaboratives.

## Project Management

After five years of development, the management structures for most of the collaboratives have now stabilized, although adjustments continue. Three of the collaboratives, Los Angeles, Philadelphia, and San Diego, underwent some changes in their governing structures during the 1989-90 school year. In Los Angeles, the expanding +PLUS+ Teachers' Council was developed into four satellite councils, each with its own teacher coordinator and representatives from six to eight schools. As the number of schools actively participating in +PLUS+ approached 30 and decision-making by the large group was more difficult, the need to form smaller councils became apparent. The satellite teacher coordinators had all been active in the collaborative and had been trained for the position. The Philadelphia collaborative took a different approach to the operations of the organization. The new collaborative coordinator, appointed by PATHS/PRISM, formed a program committee of volunteer science and mathematics teachers, divided them into three subcommittees, and asked them to develop collaborative priorities and plans. Only toward the end of the school year was the collaborative's Steering Committee (business, higher education, and other agency representatives) reconvened to advise the coordinator and the program committee. In San Diego, the governing structure underwent a complete change that evolved out of the process of writing a permanence proposal. A 25-member Board of Directors was formed including representatives from business, higher education, the military, the districts, community organizations, teachers, and parents. This group had responsibility for developing policy for the collaborative while the newly formed Council of Mathematics Education, consisting of teachers and district staff, was given responsibility for guiding the program for the collaborative.

It appears that the most common management structure for the collaboratives consists of some form of governing board (that includes representatives from business, higher education, the district, and its teachers) and a teacher advisory group. The distribution of power between these groups varies among the collaboratives. Only in San Francisco and St. Louis are the collaboratives governed by a single board.

The collaborative administrator--coordinator and/or director--has been a key factor in making these structures function. Three of the collaboratives--Durham, St. Louis, and Twin Cities-- experienced changes in key personnel in 1989-90. The appointment of the new executive director in Durham was delayed until after the beginning of the school year, causing some difficulty in organizing the collaborative's programs for the year. Installing a new director in St. Louis and a temporary coordinator in the Twin Cities, however, had little effect on the function of these collaboratives.

Nearly all of the collaboratives have been able to work out a financial plan that has enabled them to operate without devoting a lot of time to financial survival. With the reduction in Ford Foundation funding some of the collaboratives--for example, Twin Cities and New Orleans--have adjusted by scaling back their programs. In Pittsburgh, the collaborative activities have been conducted jointly with the district, thus reducing program cost. The collaboratives in Cleveland, Los Angeles, and Philadelphia have been able to garner outside funding from the district and the National Science Foundation to support at least some collaborative programs. The other collaboratives are securing support for the immediate future, but are not yet assured of long term financial stability. At the end of the 1989-90 school year, there was a structure in place at each of the sites that could muster at least some resources on behalf of mathematics teachers.

There is a question as to whether the collaboratives have put too much energy into developing and establishing their working structures and not enough effort into collaboration. In some cases, the governing body itself represents a major form of collaboration between teachers and others; such is the case with the Collaborative Council in St. Louis. In most of the collaboratives, however, the governing boards have had to concentrate on generating programs and events rather than on strategic planning. Little attention has been devoted to the various possibilities for collaboration among teachers and those in business and higher education; and little effort has been made to bring people from all of these groups together to make systemic change, advance mathematics education in the area, and affect student learning of mathematics in urban schools. In this sense, the collaboratives have been more program- and event-driven, rather than mission-driven.

## Collaboration

At all of the sites, some level of collaboration among teachers and between teachers and those in business, higher education, and the school districts has been achieved. The form this collaboration has taken has varied among sites--from socializing, giving presentations, and providing resources to interactively working with each other. While collaboration among teachers as well as collaboration between teachers and those in other sectors has already been discussed in relation to the impact of the UMC project, a few points need still to be raised. In general, the UMC project provides evidence that people from the larger community are interested in education and are willing to help. Those from the corporate or academic world who have been approached and asked to work with a collaborative have been very willing to cooperate. Sometimes this involvement has resulted from an institution's high priority to community service, but more frequently people have been willing to become involved because of their personal interest. One major problem in involving the business and higher education communities is that in general the collaboratives have not clearly defined the type of contribution they would like from these sectors. In the absence of a clear vision of how people from other sectors can best be utilized, collaboratives have frequently relied on them only as resources to provide money or to make a presentation, rather than as potential partners in true collaboration.

In a few collaboratives, representatives from business and higher education have become personally involved working with teachers and other educators to confront key issues. In order for this level of collaboration to occur, there had to be sustained involvement on the part of those from business and higher education as well as opportunity for people to get to know each other through board service, shared projects, or informal interchanges. When this has been the case, those from business and higher education have developed a more understanding view of the problems of education. A businessman actively involved on the Cleveland collaborative's Advisory Board acknowledged that the approaches needed to solve problems in education are different from those that would be used to solve business problems. A chief executive of a large corporation who has actively served on a collaborative board has developed a new appreciation of teachers in inner-city schools as a result of his interaction with them. In another collaborative, the president of a philanthropic institution noted the complexity in solving educational problems and the need to apply many approaches in the search for solutions. In his opinion, the collaborative has done very well in getting nearly all of the mathematics teachers from the district involved, one of the many steps that he views will contribute to solving some of the problems in education. Several collaboratives have been able to attract very influential people who have an important perspective to offer and have gained a new appreciation for teachers.

The collaboratives have had an impact that it was not possible to envision at the beginning of the project. Of note were the linkages established between collaboratives and national curriculum oriented projects. Both the Cleveland and Pittsburgh collaboratives have obtained NSF grants. Cleveland has recently received a second NSF grant to help fund its Model Mathematics Project. Many of the collaboratives have helped to sponsor one-week Woodrow Wilson Fellowship Foundation Summer Institutes. It is questionable whether there would have been as many institutes among the sites without UMC project involvement. The UMC network provided a context within which the Woodrow Wilson Fellowship Foundation could publicize its program and reach teachers in urban schools. All of the collaboratives have in some way helped to acquaint teachers with the NCTM *Curriculum and Evaluation Standards*. Many of the collaboratives have used as speakers and resources people with whom they have become acquainted through the larger UMC network.

A second unanticipated outcome of the collaborative project has been the formation of a strong national network that is beginning to shape a shared agenda to be addressed by all of the sites. Through this national group, the issue of equity has been brought to the forefront. This more concentrated effort has enabled individual collaboratives to address equity. As a result, nationally recognized speakers on equity have given talks on strategies for dealing with equity issues at many of the collaboratives. Another effort that is being addressed by the UMC project as a whole is the development of teacher leadership. More sites are actively pursuing leadership training for teachers. Here again, individual collaboratives have built upon the initiative of the UMC network to advance programs at their local sites.

## Professionalism

The collaboratives have generated an enlivened, enthused, and renewed group of teachers who feel empowered and supported and are being treated as professionals. The collaborative teachers have become more active in professional organizations as the collaboratives have provided funds and encouragement to attend meetings and participate in conferences and workshops. Teachers have developed leadership skills and have assumed greater leadership responsibility in working with other teachers, with district administrators, and with others. Teachers have become less defensive and more proactive in trying to resolve the many problems they face.

The greatest impact of the collaboratives has been experienced by a small group of teachers, the frequent participants, who have become committed to the collaborative concept. A larger group of teachers, occasional participants, have been touched in some way by the collaboratives, but participate selectively. A third group of teachers have resisted participation or have ignored the collaborative altogether. The size of these groups vary by collaborative. Over the duration of the project, the first two groups have expanded and have even worn down some of the resisters. The teachers who responded to both the 1986 and 1990 administration of the Survey on Teacher Professionalism provide some indication of this. Of the 60 teachers who indicated on the 1986 survey that they had never participated in a collaborative activity, 90 percent had become involved in some way by 1990; 30 percent of this group considered themselves frequent participants.

The responses of teachers to surveys and interviews, and their level of collaborative participation all indicate that the collaborative has had a positive effect in changing teachers' attitudes toward their profession, in expanding their knowledge, and in some cases modifying their own classroom practices. What has been less evident over the duration of the project has been systemic change and change in certain critical professional attributes, such as autonomy and self-regulation. Through collaboration with each other, teachers have been able to gain support for what they do from their peers and from those in district administration. Many teachers in inner-city districts, however, still face large classes, high absentee rates, and lack of control in making curriculum decisions. In a few of the collaborative districts, a decline in state revenues has created in budget problems that may result in teacher layoffs.

The collaboratives have had difficulty influencing autonomy and self-regulation, two attributes associated with being a professional. Collaborative teachers vary greatly in the sense of autonomy they feel in deciding what to teach in their classrooms. In the 1990 administration of the Survey on Teacher Professionalism, collaborative teachers in Durham, Memphis, and New Orleans, where the state exerts strong control over the curriculum, rated professional autonomy the lowest on average among the five attributes of professionalism. (The other four were professional organization, sense of calling, importance of self-regulation, and belief in public service.) In the Los Angeles collaborative, however, autonomy had the highest rating. Los Angeles teachers have indicated in interviews that the central administration exercises little control over what they teach. One Los Angeles teacher responded to a question about the independence teachers have in their schools, "No one monitors what teachers do, so they can do what they want. Textbooks dictate. It also depends on teachers to teach what they want." One Los Angeles area teacher, however, had another perspective on this issue: "We have too much control. I would like to see more standardization." There is some evidence that the collaboratives have had an influence in changing teachers' sense of autonomy as a result of giving them more opportunity to exercise their own judgement. On the Survey on Teacher Professionalism, teachers who were frequent collaborative participants increased their rating on the opportunity to exercise their own judgment more so than did teachers who were not active in a collaborative. But, overall, there was little variation on the autonomy scale between the 1986 and 1990 administrations of the Survey. One reason seems to be that while teachers feel they should be more involved in making decisions, they appear reluctant to exercise final authority. They think that others--administrators, parents, the community--should participate in making decisions about the mathematics that should be taught.

The second professional attribute that has not been significantly developed by the collaboratives is self-regulation. The mathematics teachers active in their collaboratives, in general, either do not seem to be ready to take responsibility for their organizations or for their profession, or they do not know how to. Teachers value other teachers as sources of knowledge, but are more cautious when it is a question of other teachers evaluating them. A number of teachers view their role in regulating their profession more as one of sharing and of providing constructive criticism and support than one of judging the performance of other teachers. However, one Philadelphia teacher said bluntly, "Ownership of evaluation is essential if teachers are to assume responsibility for their own performance and professional growth."

Teachers vary in their beliefs as to who should have influence over their profession. Teachers think that the professional organization should set standards for teaching and direct the reform of mathematics education but should not be evaluators of their peers, particularly with respect to tenure or pay scale level. One San Francisco teacher put it this way, "[Teachers] should have a chance to observe each other and give feedback. As far as evaluation goes, like for tenure, I don't know. That puts the teachers in an uncomfortable position. I guess maybe a teacher should be able to ask for an evaluation by his peers if he's unhappy with a principal's evaluation." Some teachers seem to be more comfortable in being evaluated by a department head than by an administrator or general supervisor who does not have knowledge of mathematics. In actual practice, most collaborative teachers reported having no role in evaluating other teachers.

The question of accountability still remains essentially untouched by the collaboratives. The collaboratives have, generally, not raised the issue of who has responsibility for student achievement and for raising mathematics teachers' standards. There is some evidence that this may change as the UMC network develops. In the draft of the UMC policy paper to address teacher professionalism that is currently being prepared under the auspices of the UMC Standing Committee, there is a reference to developing standards that will "serve as the basis for accountability in the teaching profession." What the draft communicates is that teachers need to be central to the change process, know mathematics, and be committed to student learning, professional networks, and teaching standards.

Related to the issue of self-regulation is that of leadership. As the UMC project matured, the need for teacher leaders became more apparent. Many teachers did not know how to take initiative in assuming leadership, lacking both leadership skills and leadership experience. Responsibility for operation of the collaborative at many of the sites remained in the hands of the coordinator or director. When efforts were made to get teachers to assume more responsibility, it generally took time and a concerted effort. This became a specific focus in Los Angeles. It took two years and strong support from the coordinator for the Teachers' Council to become functional and begin to make the decisions and implement activities. Parallel with the development of the Council, plans were implemented to train teacher coordinators to assume a greater leadership role. That the development of teacher leadership in a collaborative takes more than strong will was evident in St. Louis. The St. Louis collaborative began with a group of dedicated teacher-decisionmakers. This small group of teachers felt that they were making decisions for the collaborative. What was originally missing from this model, however, was the strategic planning that sought a broader focus for the collaborative and could develop coalitions with other community resources.

There have been isolated instances in which a teacher, encouraged and supported by the collaborative, has taken individual action to resolve issues faced by the system. One example is the Pittsburgh teacher who instituted a study on the relationship of attendance to the passing rate by different ethnic groups. As a direct result of her report to the district, a town meeting at which she presided was held to find a solution to the district's high absenteeism rate.

The teacher activism and enthusiasm that evolved out of the Teacher Leadership Workshop conducted by EDC gives an indication of the extent to which leadership training is needed across the collaboratives and can be productively used.

Another aspect of self-regulation that affects the collaborative teachers is their capacity to take initiative on their own behalf. In collaboratives where there has been an interval between coordinators, teachers have not always risen to fill the void. At the beginning of the 1989-1990 school year, collaborative programming in Durham was delayed pending the appointment of the executive director. As a consequence, some teachers made commitments to other activities and a few events had to be canceled due to insufficient planning time. In other collaboratives, if professional meetings were not strongly promoted, teachers had a tendency not to attend. This may indicate some lack of initiative on the part of teachers; it also affirms the importance of the coordinator in keeping teachers informed and encouraging them to be active.

In nearly every collaborative, a core group of usually less than 30 teachers has assumed ownership for their own professional growth and for the growth of the collaborative. Some teachers have flourished as a result of their collaborative involvement and have begun to develop national recognition. Others have been energized, but have found it difficult to sustain the high level of energy. In each collaborative, there is also a large group of teachers--those who tend to be in the occasional participant category--who have benefited from the collaborative, but who have not stepped forward to assume responsibility for the collaborative's ongoing program. If professionalism is defined in part as being responsible for furthering the profession and contributing time to the professional group, there is a question of the extent to which many collaborative-active teachers are professional.

Many teachers view the collaborative as a professional organization that has expanded their perception of their own professionalism. In response to the question about how the collaborative has enhanced their view as a professional, a Los Angeles teacher reported, "I am more certain there is a profession of teaching. The collaborative establishes it as a profession not just a job. I never realized that until my department got involved with +PLUS+." In Memphis, another collaborative teacher responded, "The collaborative has helped my professionalism. It is doing what a mathematics organization should be doing. I feel that I am qualified to decide what and how my students should be taught. I'm not so different from the many other mathematics teachers around the country."

## Mathematics Focus

It is evident that the UMC project has impacted on mathematics education at all of the sites. Essentially all of the collaborative teachers interviewed identified the influence the collaborative has had on the way they are now teaching mathematics. The changes sited include a greater awareness and use of technology (computers and calculators) by collaborative teachers, the need to include less traditional topics such as probability and statistics in the curriculum, and a greater emphasis on problem solving. The collaboratives that have made the greatest advance in effecting system-wide change in the teaching of mathematics are those that have worked closely with the mathematics supervisors--Pittsburgh, which has organized on-going curriculum committees, serves as a good example. Throughout the UMC project, teachers have reported on their readiness to take risks; they also have indicated that they have become more knowledgeable of what is current and that they have experienced the support needed to make changes in the way they teach. In each of the collaboratives, there are at least some teachers who are teaching mathematics differently from the way they taught before they became involved with the collaborative.

Changes have occurred in the teaching of mathematics as a result of the collaborative's efforts, but an underlying question remains of just how widespread these changes are and how they affect what students learn about mathematics. We do not have information that fully answers this question. As we have monitored the development of the project over a six-year period, however, we have gained a better understanding of factors that seem important to achieving change in the teaching of mathematics in inner-city schools. These factors include the conditions of teaching; teachers' education and experience, as well as their conception of mathematics; the availability of resources; and the presence of strong leadership--all of which vary among the different sites to such an extent that it is meaningless to think in terms of one urban solution without considering the local variations at each site.

The teachers served by the collaborative vary widely in terms of age, experience and education, as indicated by responses to the Secondary Mathematics Teacher Questionnaire. This survey, which was designed to gather background information on collaborative teachers, was administered to frequent collaborative participants between the fall of 1986 and early spring of 1988. Survey results revealed that some of the collaboratives are servicing a relatively high percentage of young, inexperienced teachers, whereas in other sites the teaching force is skewed toward older experienced mathematics teachers. In Los Angeles and Durham, the mean number of years of experience in teaching is close to 12, with only one fourth of the teachers under the age of 30. In contrast, the mean number of years of teaching of collaborative participants in New Orleans, Cleveland, Pittsburgh, and San Francisco is over 18 years; only a very low percentage of teachers are under the age of 30. In addition to differences in teaching experience, teachers vary in their formal education in mathematics. About one fourth of the collaborative teachers majored in education as undergraduates. In the Twin Cities, Durham, and New Orleans, over 60 percent of the teachers have an undergraduate degree in mathematics whereas in Los Angeles and San Diego less than 40 percent do. In San Diego, a few teachers have reported a chasm between "mathematics majors" and "non-mathematics majors" in their school when it comes to teacher perceptions about the number of students who should have algebra. The teachers who were mathematics majors supported a requirement that all students have some algebra whereas the others question this need. The range in teachers' background and formal mathematics education and the differences in their percentages among the sites provide strong evidence for differing professional development needs at each site.

Not only do inner-city teachers show a wide variation in educational background and experiences, but teachers from different sites vary to some degree in their conception of mathematics. The results on the Survey of Teachers' Conceptions of Mathematics and Mathematics Education distributed to teachers in all of the eleven collaboratives indicate that across all of the sites, teachers agree fairly strongly that mathematics is thinking and that the teaching of mathematics should enable students to reason and solve problems. But in considering other aspects of mathematics, teachers vary by site. In New Orleans, teachers agreed more strongly with the definition of mathematics as facts, skills, rules, and concept, whereas teachers from San Francisco and the Twin Cities were significantly lower in their agreement with this view of mathematics. San Francisco mathematics teachers conceived of mathematics as a language to a greater degree than did teachers from the other collaboratives. San Diego teachers supported both the "logic and skills" aspects of mathematics. New Orleans teachers were significantly lower in agreeing that computers and calculators enhance comprehension of mathematics topics than were the teachers in San Diego and the Twin Cities, who felt that the introduction of new technology into the curriculum was very important. The responses of teachers to the Mathematics Conceptions Survey and to questions asked them during interviews indicate that there are significant differences in how mathematics teachers view what mathematics is and that these differences influence their teaching. In planning for change in the teaching of mathematics in inner-city schools, it is important to note that certain conditions related to the students are similar across the collaborative sites, such as high absenteeism, large class sizes, and lack of student interest. And yet, the beliefs and backgrounds of mathematics teachers in inner-city schools can vary to such an extent that one cannot generalize programs across sites without taking these fundamental differences into account.

Another factor in achieving change has been the availability of adequate resources. In general, the collaboratives have provided teachers with a rich variety of experiences. These experiences have been planned to accommodate the differences in the participants' teaching levels, knowledge of mathematics, and interests, as well as to take advantage of the expertise available. The collaboratives have done well in raising the teachers' awareness of current recommendations and providing them with skills that can be applied in their teaching. While the collaboratives have been successful at offering programs that provide information, they have been less successful at offering goal-directed programs--such as a well planned series of events--leading to needed change. In general, the collaboratives have had difficulty bringing in people from business and higher education to share in setting goals and devising programs to achieve those goals. This might be related to the level of maturity of the collaborative and perhaps can be dealt with only after survival issues have been addressed. A few of the collaboratives have reached this stage. One is Cleveland, where the Advocacy Committee developed support for the Model

Mathematics Project. Another is Pittsburgh where curriculum committees have met over a period of years to plan changes. Out of this model, a problem-solving course was created and implemented to replace the traditional 9th-grade general mathematics course. On a different scale, a goal-directed approach was followed in Los Angeles through the +PLUS+ departmental planning process by which department members develop a school mathematics plan for each year. In Los Angeles, however, the process has not been extended throughout a satellite or district so that everyone is working together to develop a comprehensive plan for change.

## The Challenge of the Future

It seems to take five or six years for a collaborative to become established and gain recognition. Most of the collaboratives have done this successfully. Developing programs that lead to system-wide change, however, seems to take even longer. This appears to be yet another stage in collaborative development--one that also requires financing and the coordination of people from all sectors. A few of the collaboratives have developed models of this second major stage. These models have the potential of being adapted by other collaboratives. The question remains of how many of the collaboratives will be satisfied with what they have obtained to this point, choosing either to maintain their current level of activity and support, or close shop--or how many will build on what they or other collaboratives have learned to achieve major changes in the system.

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# APPENDIXES

## SUMMARY REPORTS FOR THE ELEVEN URBAN MATHEMATICS COLLABORATIVES

A. Cleveland Collaborative for Mathematics Education (C²ME)
B. Durham Collaborative: The Durham Mathematics Council
C. Los Angeles Urban Mathematics/Science/Technology Collaborative
D. Memphis Urban Mathematics Collaborative
E. New Orleans Mathematics Collaborative
F. Philadelphia Math Science Collaborative
G. Pittsburgh Mathematics Collaborative
H. St. Louis Urban Mathematics Collaborative
I. San Diego Urban Mathematics Collaborative
J. San Francisco Mathematics Collaborative
K. Twin Cities Urban Mathematics Collaborative

The following reports are summaries of each of the eleven original Urban Mathematics Collaboratives funded by the Ford Foundation. Although the reports were prepared by staff of the Documentation Project, the content of each report was sent to the individual collaboratives for final approval.

# SUMMARY REPORT:
# CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION (C$^2$ME)

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Cleveland Collaborative for Mathematics Education (C$^2$ME) during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Cleveland Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

# CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION ($C^2ME$)

## A. Purpose

The Cleveland Collaborative for Mathematics Education is guided by a four-year work plan that covers the years from 1988 to 1992. The mission for the collaborative, as stated in the plan, is:

> To enhance the professionalism and effectiveness of intermediate and secondary school mathematics teachers by providing opportunities for collegiality, training/ professional growth and curriculum development that will enable them to deliver contemporary mathematics education which enhances critical thinking skills and the use of technology and models; and
>
> To involve teachers, local business/industry, community members and parents in a shared perspective of contemporary mathematics instruction in the Cleveland Public Schools.

In support of this mission the $C^2ME$ has identified four goals:

1. To enhance the collegiality of intermediate and secondary mathematics teachers in the Cleveland Public Schools;
2. To enhance the effectiveness and efficiency of mathematics instruction;
3. To develop a contemporary mathematics curriculum that emphasizes critical thinking and the use of technology; and
4. To articulate the mathematics program to all members of the Cleveland community.

## B. Context

The Cleveland Public Schools (CPS) district serves a population of 500,500 people. Cleveland is in an area referred to by business economists as the "rust belt," an area hard hit by a decline in industrial manufacturing of steel-made products. Steel, however, is still the area's dominant manufactured product and BP America is a major employer in the labor market. The city still leads all Ohio cities in the number of manufacturing facilities, but during 1989 it lost 52 factories, leaving a total of 2,643 plants. The suburbs of Cleveland are gaining the facilities that exit Cleveland proper.

Cleveland elected Michael R. White as mayor in November, 1989, the second black mayor in recent history. The improvement of schools was a campaign issue. The quality of Cleveland schools is one reason given by people with children for leaving the city and one of the reasons families are hesitant about moving to the city. In response to his campaign promises, Mayor White convened the Cleveland Summit on Education on May 22, 1990. The Greater Cleveland Roundtable, the Cleveland Initiative for Education, and the Cleveland Public Schools were the other conveners. Over 700 people from the Greater Cleveland area including students, parents, administrators, teachers, and business and community leaders mapped out a 10-year strategy to improve the quality of education in Cleveland. The vision for the year 2000 is for the Cleveland Public Schools to be nationally recognized for their excellence and their guarantee of equity for all students. Eight 10-year goals were specified: (1) improving academic achievement, (2) developing meaningful parental/guardian involvement in all aspects of their child's education, (3) providing appropriate early childhood care, (4) putting in place effective and interactive communications with stakeholders internal and external to CPS, (5) fully integrating school buildings into the community by using them as sites for the delivery of community-based programs, (6) enhancing the self-esteem of every child from a multicultural perspective, (7) benefiting children and families through a partnership of the CPS and public and private human services, and (8) having every school be a child-focused, locally managed, community entity directed toward maximum student achievement.

An agenda of action was developed to achieve these goals. A series of seven luncheon meetings were held during the summer and were called the "Mayor's Monday Town Meetings on the Cleveland City Schools." Collaborative teacher Rosemary Lemieux of Central Intermediate School was one of two speakers at the first meeting. Speakers at other meetings included Ms. Patterson, the director of the CEF, and Mr. Huml, superintendent of Cleveland Public Schools.

Cleveland Mayor Michael R. White also campaigned with promises to increase the number and availability of police officers, to combat drug trafficking and use, and to assist in the revitalization of neighborhoods and the downtown Cleveland area. The mayor, police department, and school district share a major concern over the quantity of illegal drugs in the city and their use by school-age members of the community.

The Cleveland Public Schools (CPS) has a seven-member elected board, each member serving a four-year term. In November, 1989, five of the seats were up for election, four full-term and one two-year partial term. Seventeen people actively sought the five vacated board positions. Some candidates campaigned individually and other names were presented in slates of five, the product of a public relations firm.

The superintendent, Dr. Alfred Tutela, came to Cleveland from Boston in 1979 as part of a court-appointed enforcement team to desegregate the CPS. He served in a variety of administrative support roles before being named superintendent in the fall of 1986, with a five-year contract. During the 1989-90 school year, Dr. Tutela's salary was $97,200. Friction developed between Dr. Tutela and Board members which led to lawsuits and counterlawsuits. In May, 1990, with 14 months of his contract remaining, the board offered to buy out the balance of Dr. Tutela's contract at a cost of $330,000, as they had done in 1985 with Tutela's predecessor, Dr. Boyd. (Dr. Boyd had barely served for one year as superintendent when the board purchased his contract for $300,000.) Upon Tutela's acceptance of the Board's buyout offer, Frank J. Huml, who had served in a number of CPS administrative capacities, was named acting superintendent and was subsequently offered a two-year contract. The media leveled strong criticism at the Board for wasting education dollars on the two buyouts, particularly at a time when CPS is experiencing serious budget shortfall problems.

The 1989-90 general fund budget for CPS was $429,700,000 with a predicted $20,000,000 deficit for the 1990-91 school year. The projected 1990-91 budget is $417,500,000. State revenues provide 56 percent of the budget funding, local taxes 41 percent, and other sources 3 percent. Federal funding is negligible. State fiscal control was exerted on CPS for three years; tax levies failed and throughout Ohio school districts suffered from frozen state education funding. The proportion of the budget spent on direct instruction, which now represents $40 million, has increased from 48 percent in 1985 to 55 percent in 1989. Current CPS per-pupil expenditures are $4,950. The student/teacher ratio across all grades is 25:1.

In 1976, both the local and state Boards of Education were found liable for purposeful racial segregation in CPS. The district has been working on the implementation of the court-ordered desegregation plan, the Remedial Order, for reform in 14 areas. In 1988-89, the district completed the first yearly cycle of assessment and reported on all 14 components for compliance. In an effort to provide equal opportunities for students, more than a dozen magnet and vocational schools and five new thematic school programs now offer educational choices to 69,500 students. There are 127 schools in the district: 12 comprehensive senior high schools (grades 9-12) with 13,773 students; 20 intermediate schools (grades 7-8) with 9,430 students; 79 elementary schools (grades K-6), with 41,113 students, and 16 magnet/special design schools (grades K-12) with 3,899 students. More than 750 additional CPS students attend special educational programs in institutions.

An enrollment of nearly 69,500 students makes Cleveland the largest school district in Ohio. The student ethnic composition is: black, 70 percent (48,451); white, 23 percent (16,092); Hispanic, 6 percent (3,863); Asian, 1.35 percent (940); and American Indian, .22 percent (152). The diversity in Cleveland's ethnic composition includes a large Balkan population. There are 2,659 students in CPS who are enrolled in bilingual programs and whose language needs are being met at 14 school sites in ten languages.

CPS serves more than 750 students who are in hospitals and other institutions, and there is the concern that the number of students in special programs will be increasing. As stated in the CPS 1988-89 Annual Report ". . . the use of drugs, particularly the increase in crack cocaine--has made the challenge of serving our students more difficult. In the future we will serve more and more of the medically fragile children of drug users."

Approximately 70 percent of the families served by CPS qualify for low cost or free federally funded school lunches. More than 60 percent of all students in the district are from families who live at or below poverty level. Combined free or reduced-price school breakfasts and lunches served a daily total 68,438. Approximately 140 students in the district spend their nights in homeless shelters on a regular basis.

The dropout rate, an annual calculation based on the percentage of enrollment, is 17.5 percent at the high school level and 1.5 percent at the intermediate school level. District projections indicate that up to half of the students who enter 7th-grade will drop out of school without a diploma; of these some may return. An extremely high number of teenage parents in the district prompted the creation of three licensed child care centers to help the parents finish school. Another program, GRADS, is located in eight schools and supports the efforts of pregnant students and young parents to stay in school and graduate. Parents aged 16 to 30 are eligible to work toward a GED certificate under the GOALS program and the Adult and Continuing Education Division allows pregnant students to attend the DePaul Center. Other programs designed to keep students in school are: Project Perform, Operation Succeed, Project Success, The Entrepreneur Program, the Middle College Program, Alternative to Expulsion Program, and a Saturday "Breakfast Club" which focuses on suspended students and their parents.

At the beginning of the 1989-90 school year, a new attendance policy was instituted. Students who are absent more than 10 times in one marking period automatically receive a failing grade.

During 1988-89, 74.8 percent (14,167) of all high school students (18,940) were enrolled in mathematics courses. High school graduation requirements for CPS include 4 units of mathematics. Nineteen percent of the students who graduate continue with postsecondary education. SAT scores for 1990 (a yearly summary) were 350 on the verbal portion and 372 on the quantitative portion for an overall score of 722. In 1989, the average quantitative score was 384, compared to the Ohio average of 497 and the United States average of 476.

At the beginning of the 1989-90 school year, 9,430 intermediate school students were enrolled and at the close of the school year, 7,981 students remained. The decline in enrollment during the year accounted for 15.36 percent of the intermediate student population. The ethnic population at the intermediate level is: 68.8 percent (6,494) black; .23 percent (22) American Indian; 1.29 percent (122) Asian; 5.9 percent (556) Hispanic; and 23.7 percent (2,235) white.

CPS employs 4,013 teachers; 1,273 teach in high schools and 686 of the high school teachers are female. In 1988-89, the district added a total of 120 mathematics, science, and foreign language teachers. One-hundred twenty-one secondary teachers teach mathematics: 76 males (62.8 percent) and 45 females (37.2 percent). The ethnic population of high school mathematics teachers is: 63 white males (53 percent) and 32 white females (26 percent); 11 black males (9 percent) and 11 black females (9 percent);

one Hispanic male (1 percent); one Asian male (1 percent), and two Asian females (2 percent). There are 67 mathematics teachers at the intermediate level: 35 males (52.3 percent) and 32 females (47.7 percent). Intermediate teacher ethnic populations are: white, 41 (61 percent); black, 23 (34 percent); Hispanic, 1 (1.6 percent); Asian, 1 (1.6 percent); and other, 1 (1.6 percent). The average secondary teacher has 17 years of experience and 5 1/2 years of training.

In 1989-90, the minimum salary for a teacher with a BA or provisional certificate was $21,028 and a maximum of $44,601 with a master's degree. The average mathematics teacher's salary in 1989-90 was $34,931. Previous contract approval in December, 1989, covered the period of September, 1987, through September, 1990. At the close of the reporting period, negotiations were in progress for a new ratification. School days number 185 for teachers and include five paid inservice days. All CPS teachers are fair-share members of the Cleveland Teachers Union, Local No. 279, American Federation of Teachers, AFL-CIO; the union also acts as the bargaining agent for contract negotiations. For the past two years, school administration members and the Cleveland Teachers Union joined efforts to create a career ladder program for teachers; teachers could earn as much as $4,000 more per year under the plan's provisions. In October, 1989, as a result of budget cuts and lack of funding, implementation of the career ladder plan was in jeopardy, and by October, 1989, the program had to be shelved, although then-Superintendent Tutela considered it potentially the best career ladder of its kind in the nation.

## Professional Development Opportunities for Teachers

As the funding host for the $C^2$ME, as well as for the science collaborative and the newly created writing collaborative, the Cleveland Education Fund (CEF) has a deep investment in the Cleveland Public Schools. Improving the quality of education in CPS as well as responding to the needs of teachers are primary goals of the organization. Through its Small Grants program over the past six years, CEF has awarded more than $310,000 for teacher-initiated curriculum projects and supplementary classroom materials. CEF awarded small grants of $60,300 during fiscal year 1989 for 142 classroom projects. The School-Team Enrichment Project (STEP) grants program, sponsored by CEF, awarded a total of $17,000 in 1989 for 16 school-wide projects, intended to improve academic achievement, attendance, group relations, and leadership skills. CEF sponsored a variety of workshops and lectures related to mathematics, science, and/or writing during the 1989-90 school year. The Cleveland Education Fund publicized these activities as well as opportunities for professional development offered by other agencies through a monthly publication, *Collaborative Update*. An average of 85 percent of CPS secondary mathematics and science teachers are involved in CEF-related activities and programs.

The Cleveland Education Fund held its annual meeting June 5, 1990, at The University Club. Dixie Goswami, Clemson University professor and director of the writing program at the Bread Loaf School of English, was the keynote speaker. Her address was entitled, "Active Literacy: Teachers and Students Together." CEF Small Grant winners were invited to the annual meeting and recognized for their accomplishments.

Cleveland mathematics teachers were provided a variety of opportunities for professional development during 1989-90. The Cleveland Children's Museum, for example, sponsored (along with four other organizations including the CEF) a lecture, "Making Urban Schools Effective" by noted Yale educator, Dr. James Comer, in March, 1990; a dinner symposium on the importance of high school mathematics for engineering studies in April, 1990; and a lecture by State University of New York-Binghamton (SUNY) Professor Peter Hilton on "The Crises in Mathematics Education in the U.S.A.," also in April. These events were held at Cleveland State University. The Jane Addams Business Careers Center, a Cleveland high school, hosted a Telecommunication Conference for secondary CPS teachers in May. This was a CPS program sponsored by its special projects unit and in coordination with $C^2$ME. The Oberlin Teachers Academy hosted a Summer Institute in June, 1990, for secondary teachers.

Mathematics teachers in Cleveland have the opportunity to participate in a variety of activities offered by the Ohio Council of Teachers of Mathematics (OCTM) as well as the Greater Cleveland Council of Teachers of Mathematics (GCCTM).

OCTM sponsored a Mathematics Teleconference on April 4, 1990, for two hours, hosted by Channel 25 WVIZ Community Television. The teleconference reviewed the *Curriculum and Evaluation Standards for School Mathematics* developed by NCTM and focused on the use of technology and manipulatives in Ohio classrooms. A variety of experts were featured speakers and taped comments from experts statewide completed the program. Collaborative teacher William Stiggers was featured in a segment that addressed the use of new technology in teaching. Cleveland Mathematics Supervisor William Bauer and $C^2$ME Advisory Board member and Baldwin-Wallace College faculty member Professor Richard Little also participated in the conference. Packets of printed material were made available for each teleconference site (school district) for a $25 fee. Teachers at enrolled sites were able to call during the program to ask questions or contribute information.

GCCTM holds regular meetings in Cleveland with programs focused on mathematics. In November, GCCTM East District sponsored a program that featured on-site observer and CPS mathematics teacher Robert Seitz, speaking on "An Evening of Mathematics with a Viennese Flavor." Robert Seitz is vice-president of the organization and president of the Central District.

The Cleveland Teacher Internship Program (CTIP), which was established in 1980, coordinates summer work placement in the private sector for CPS teachers in communications, computer science, laboratory sciences, mathematics, and technical writing. The program's objective is to provide Cleveland-area teachers with opportunities for professional growth and first-hand experience in the workplace so they can return to their classrooms well- versed in the kinds of skills and knowledge their students will need in the world of work. During the summer of 1989, six CPS mathematics teachers worked as interns in local businesses. The internships lasted from seven to ten weeks. The weekly stipends were $300 plus a $50 per week increase for each previous year of program involvement. In addition to working at the corporation, teachers attended five afternoon seminars over the course of the summer and prepared a learning project for their own classrooms. Teacher interns also enrolled for one to seven graduate credits at CSU in conjunction with these projects. Interns met in October to share their completed work; seven CPS teachers have been selected to serve as 1990 summer interns through Cleveland's Teacher Internship Program. Many of the companies that conduct intern programs specifically request Cleveland teachers.

Several collaborative teachers were nominated for awards during the 1989-90 school year: Dolores Dugan, who created a mathematics laboratory at an intermediate school, was the recipient of the Battelle Award for Professional Development in Mathematics from the

Ohio Academy of Science and the Battelle Memorial Institute. She received an engraved trophy and a $3,000 check to be used for personal professional development in the 1990-91 school year. Richard Wittman was nominated for the Presidential Mathematics Teacher Award and Tandy Scholar Award; Ron Brahler was nominated for an Ashland Oil Award for Teaching, and William Stiggers was nominated for the GCCTM Outstanding Educator Award; Maija Zuby was named GCCTM's Central District Teacher of the Year. Robert Seitz, 1989 Presidential Award winner, was invited to accompany 50 top students from Ohio to a space shuttle launch at Cape Canaveral in May, 1990. Collaborative mathematics teacher Rosemarie Lemieux was featured in the April, 1990, *Cleveland Magazine*; senior writer Mary Mihaly spent a week at Central Intermediate School in Cleveland to research the story.

Activities that Integrate Mathematics and Science (AIMS) workshops were held in April and May, 1990, for CPS intermediate mathematics and science teachers. Workshops featured hands-on materials that reinforce both mathematics and science skills. Two graduate credits were offered for the workshop series held on the Cuyahoga Community College (CCC) Metro Campus.

In April, 1990, Cleveland State University sponsored an address by SUNY Professor Peter Hilton on "The Crisis in Mathematics Education in the U.S.A." Professor Hilton is an internationally known leader in advanced mathematics research and former chair of the U.S. Commission on Mathematics Instruction. On April 19, 1990, as part of the Mathematics Awareness Week activities, John Carroll University Professor Robert Kolesar introduced the film, "Mathematics is Sometimes Pure," and led a discussion.

The Oberlin Teachers Academy sponsors a variety of programs for mathematics teachers in the area. In November, for example, the Academy sponsored a workshop on discrete mathematics for high school teachers. The all-day session was free to CPS teachers. In June, 1990, the Oberlin Teachers Academy offered two-, three-, and four-week summer institutes for secondary teachers on the Project to Increase Mastery in Mathematics (PIMM). Scholarships and graduate credit were available to participating teachers.

A NASBE symposium will be held at Case Western Reserve University August 3-5, 1990, on "Improving Math and Science Education in the Nation's Schools." Although the symposium is a major national leadership symposium for chairmen of state boards of education, twenty teachers (10 in mathematics and 10 in science) from Cleveland have been invited to attend as special guests.

**Student Educational Opportunities**

The Greater Cleveland Roundtable, headed by Chairman John F. Lewis, is a non-profit organization of community leaders and businessmen that works to promote education, race relations, and minority economic development. During the 1989-90 school year, Mr. Lewis wrote an editorial for a local newspaper urging that the community support the school board, school administrators, and educational equity.

Concern over the high dropout rate at the 10th-grade level spurred the creation of the Cleveland Education Partners (CEP) program. Begun in 1988, the CEP program pairs each intermediate and high school with a local business or non-profit organization. Each partner establishes its own way of working with its school partner. Some provide volunteers while others contribute financial resources. Most recently, the city's 12 high schools and 11 intermediate schools have developed a corporate partners program. The partners' program brings a corporate perspective to students through activities such as tutoring, career planning, attendance recognition, and interview skill workshops. Corporate partners are starting to go beyond career planning and are becoming more interested in helping schools with their management organization.

On January 25, 1990, the State of Ohio granted $2 million and within a short period of time presented $1 million of this award to the Scholarship-in-Escrow (SIE) Program of CPS. The program was initially developed by the Greater Cleveland Roundtable at the suggestion of former Superintendent Alfred Tutela. Designed to function as an incentive for improving student achievement and to defray tuition costs for college-bound students, the program awards money in escrow for students (grades 7-12) contingent upon grades earned in major subjects. Students receive $40 for an A, $20 for a B, and $10 for a C, while those in honors courses receive an additional $10 for each grade earned above a C. A strong feature of the SIE program is that it places advocates in schools to help direct students toward college. Several colleges and universities in the area have agreed to give additional support to students who use SIE funds at their institutions. Since February, 1988, SIE dollars available have totaled $7,200,000. In the first marking period of the 1989-90 school year, $1,105,960 was expended, distributed among 65 percent (19,154) of eligible CPS students.

## State Support of Education Initiatives

Senate Bill 140, which was passed in 1989 by the 118th Session of the Ohio Assembly, provided many major educational reforms for the State of Ohio. A section of the reform bill makes provisions for "post-secondary enrollment options" for eligible 11th- and 12th-grade students. Students are allowed to enroll in a public university, college, or accredited technical school on a full or part-time basis while they are 11th- or 12th-graders. Courses at the postsecondary level may be taken for either high school or college credit. CPS students who will begin 11th- or 12th-grade during the 1990-91 school year will be eligible for the program. There is no cost to students who take high school credits but students taking courses for college credit are required to pay tuition and other expenses.

Substitute House Bill 231, passed in July, 1987, established a state-wide proficiency testing program for all Ohio high school students. Testing ensures that students who earn a regular diploma have at least a 9th-grade proficiency in reading, writing, mathematics, and citizenship (U.S. government). Test results will be used to determine the type of diploma students receive when they graduate from an Ohio public school. Beginning in the fall of 1990, students at the 9th- and 12th-grade levels will be tested twice yearly. Ninth-grade students who do not receive a passing score on their first attempt will have a minimum of seven additional testing opportunities. The 12th-grade test will be administered to students who have successfully passed the 9th-grade proficiency tests and are scheduled to graduate after July, 1993. The State of Ohio Department of Education awards four diplomas for all state public schools: certificate of attendance, diploma of basic competency, diploma of distinction, and diploma with commendation.

## C. Development of the Collaborative

The intermediate and secondary school mathematics teachers, the district mathematics curriculum director, business representatives, higher education representatives, and administrative staff of the Cleveland Education Fund (CEF) constitute the Cleveland Collaborative for Mathematics Education ($C^2ME$). Barbara H. Patterson, director of the Cleveland Education Fund, serves as director of the collaborative. In this capacity, Ms. Patterson is responsible for implementing the policies of the Advisory Board, raising funds through the Education Fund, supervising the business and financial operations of the collaborative, supervising collaborative staff and volunteers, pursuing effective relationships with community leaders and school officials, and interacting with the larger UMC network. The day-to-day administrative responsibility for the $C^2ME$ belongs to Joseph Flynn, the collaborative coordinator. Mr. Flynn, who works full time for the CEF, has been with the CEF since June, 1987, and was its acting director for a brief period until Ms. Patterson was appointed. Mr. Flynn is also the coordinator of the Cleveland Science Collaborative. Robert Seitz, the mathematics department head at John Adams High School in Cleveland, is the on-site observer.

### Advisory Board

The 34-member Advisory Board generally met the third Monday of every second month during the 1989-90 school year to oversee the operation of $C^2ME$. Members of the Advisory Board include scientists, engineers, mathematicians, educators (secondary and post-secondary), and representatives from the fields of finance, accounting, and applied mathematics (product design and technological advancement). In addition, eight Cleveland Public Schools mathematics teachers and Bill Bauer, the district mathematics supervisor, serve on the Board. Barbara Pence, Vice President for Branch Administration of the National City Bank, was the chairperson of the Advisory Board during the 1988-89 and 1989-90 school years.

The Advisory Board met five times during the school year. The attendance at the meetings ranged from 18 to 22 members with an average attendance of 20. Each meeting was also attended by the director of the Cleveland Education Fund, the collaborative coordinator, and an administrative assistant. All listed members of the Board attended at least one meeting during the school year. Three new members were added during the year to replace members who could no longer serve on the Board. The Advisory Board has five committees: Teachers Advisory Group (chaired by Richard Wittman), Board Development (chaired by Bob Miller), Program Committee (chaired by Bob Seitz), Advocacy Committee (chaired by Dick Klein), and Public Relations Committee (chaired by Dick Baznik). These committees meet in between Board meetings. An Executive Committee, composed of the chairpersons from each of the standing committees and the officers of the Board, acts in the name of the collaborative when circumstances preclude meetings of the full Board.

The Advisory Board meetings generally included reports from each of the five committees, announcements, reports on special projects such as the NSF Problem-Solving Infusion Project, and some decision making. Specific action taken by the Board during the year included establishing a procedure for amending the by-laws; setting the terms of office of the Board members to one year for a third of the members, two years for a third, and three years for a third; approving in principle the endorsement of the NCTM *Curriculum and Evaluation Standards*; and electing Dick Klein to serve as Board vice chair and Bob Salipante to serve as Board treasurer. Much of the work of the Board is done through its committees. A survey listing the five standing committees was sent to teachers in May, 1990, asking them to indicate which of the five committees they would be interested in serving on.

## Teachers Advisory Group

The Teachers Advisory Group (TAG) provides counsel to the Advisory Board on issues of special interest and concern to mathematics educators. The Teachers Advisory Group met four times during the school year on Tuesday or Thursday afternoons at 3:30 p.m. at the Mathematics Teachers' Resource Center, Cuyahoga Community College. Of the seventeen teacher members, attendance ranged from 11 to 16 teachers and averaged an attendance of 13. In addition, the collaborative coordinator and an administrative assistant attended three of the four meetings. The group discussed the programs of the collaborative and provided their input on issues facing the collaborative. At the September 14, 1989 meeting, the teachers prioritized a list of prospective activities for the collaborative. In order of priority, the activities consisted of (1) teacher-by-teacher workshops; (2) an album/slide show for public relations purposes and a mathematics fair, tied for second priority; (3) a city-wide mathematics club; (4) job shadowing; and (5) a program on the role of higher education in implementing the new *Standards* and CPS hosting GCCTM, tied for fifth priority. Other activities listed were class visitations to universities and presentations at the Education Computer Consortium of Ohio (training program in the use of technology). The collaborative coordinator noted that if funds contributed by Aetna Life and Casualty were to continue to support the mathematics clubs, the clubs may have to focus on certain priorities set by Aetna, including the retention of students in school and student entry to the world of work or college. The group also discussed hosting a Woodrow Wilson Fellowship Foundation one-week summer institute in Cleveland.

At the October 12, 1989 meeting, TAG decided that the collaborative should support the attendance of teachers at three events during the school year: the regional NCTM meeting to be held in Philadelphia; the OCTM meeting to be held in Zanesville; and the NCTM Annual Meeting to be held in Salt Lake City, Utah. TAG members felt that they were in the best position to decide which teachers should attend these conferences. They decided to include in the data base teachers who are certified to teach secondary mathematics and elementary certified teachers who were at the intermediate level and were actively teaching mathematics during the school year.

On February 20, 1990, the Teachers Advisory Group developed a set of criteria for supporting teachers' attendance at the OCTM meeting and the NCTM Annual Meeting. The collaborative is to support those teachers who are active in their school mathematics departments. The amount of support was set at $80. Only six of the teachers attending the OCTM meeting will be eligible for C$^2$ME assistance to attend the NCTM Annual Meeting. The group felt that those who go to NCTM should present a workshop at the next OCTM. The chair announced that the Advisory Board chairman had arranged a meeting with this group of teachers and Superintendent Tutela at a future date. The teachers also were asked to volunteer or suggest the names of other teachers who would be good candidates for offices in the GCCTM.

On May 8, 1990, the discussion on attendance at meetings was continued. Mr. Flynn reported that in the 1990-91 budget there are no travel funds for teachers. Options were then discussed of actions to be taken to solicit financial support, such as approaching the district or seeking support from corporate partners. The group voted to tighten the criteria for providing C$^2$ME travel support to teachers who belong to NCTM, OCTM, and GCCTM; are active in the collaborative; or are new teachers. The group decided to limit its membership to a minimum of 15 members and a maximum of 21 members. In 1990-91, TAG membership will be increased from 17 to 21 members. One-third of the group will serve one-year terms, one-third will serve two years, and one-third will serve three years. Teachers whose terms end can be renominated after one year off the board. Some attempt will be made to have a certain percentage of new teachers (five years or less of experience) serve on the TAG. A nominating committee was appointed. The meeting with Superintendent Tutela was set for Tuesday, May 31, 1990, at Ms. Pence's home. The meeting was canceled because of the change in superintendents.

## Program Committee

The Program Committee is to develop and monitor programs and services offered by the C$^2$ME. These are to be oriented to teachers' needs and the collaborative's goals. This committee met twice at the beginning of the school year to plan programs for the year. On September 13, 1989, the group reviewed existing programs and generated a list of suggested new programs that was submitted to the Teacher Advisory Board for action. In November, the group met again and drafted a prospectus for developing a job-shadowing project to encourage teachers to visit people in industry and observe what they do. The committee worked to develop goals and objectives for a pilot program for this project and to find funding to provide substitutes for participating teachers.

## Advocacy Committee

The Advocacy Committee articulates the role of the collaborative in advocating advancement and/or reform in mathematics education. This group met four times during the school year. Its major task was to develop the criteria and make the awards for the model high school project. This program was envisioned to enhance the secondary mathematics program of the CPS by assisting two mathematics departments in the development of programs to increase enrollment of students in higher mathematics courses and build upon the NCTM *Curriculum and Evaluation Standards*. The idea behind the project is to generate successes that can be shared with administrators and others. A subgroup of the committee met with Superintendent Tutela to secure his endorsement. During the year the CEF obtained funding to support this project. The committee established criteria for selecting departments, reviewed the proposals submitted by schools, selected five finalists, visited and interviewed members of departments from these schools, and awarded grants to two mathematics departments.

## Public Relations Committee

The Public Relations Committee recommends and plans the public relations programs for the C$^2$ME. During the school year, members of the group generally worked individually on specific program activities in coordination with the chair. The activities included a TV public service program appearance, exploring the possibility of having a media person recount the experience of being a mathematics student and visiting a classroom, a mathematics fair, two-way job sharing, and publicizing a corporation's annual report showing the role mathematics plays in corporate activity. The chair observed that examples of non-traditional, self-directed, focused, state-of-the-art teaching, which contradicts stereotypes and had been identified through C$^2$ME, could be publicized. In November, the chair reported he had made contact with a television station in conjunction with doing a story on a mathematics teacher. In January, the chair indicated that a reporter for *Cleveland Magazine* would shadow a middle school mathematics teacher for five days and then do an article for a local magazine some time in April or May. The teacher cautioned about presenting a negative impression and asked to review the article before publication. When the article was written, a copy was sent to C$^2$ME teachers and members of the media.

## Board Development Committee

The Board Development Committee nominates people to serve as members and officers on the Advisory Board and, from time to time, reviews the by-laws. This committee met once during the school year, on September 18, 1989. At this meeting, its members developed a procedure for amending the by-laws and specified the terms of office of all Board members; both actions were approved by the Advisory Board.

## D. Project Activities

In keeping with its goals to provide teachers with opportunities for professional growth, to offer inservice training, and to enhance classroom instruction, $C^2$ME sponsored a variety of programs for intermediate and high school mathematics teachers during the 1989-90 school year. In addition to activities offered by the collaborative, $C^2$ME encouraged teachers' participation in a variety of local and national institutes, seminars, workshops, and conferences.

### "For Teachers By Teachers" Workshop

To launch the 1989-90 school year, $C^2$ME sponsored a workshop, For Teachers By Teachers, on August 24, 1989, from 8 a.m. to 1:30 p.m. Participants had the opportunity to preregister for two of six possible sessions, all to be presented by Cleveland Public School (CPS) teachers. Four sessions were offered: Computer Graphing and the Electronic Chalkboard, NSF Problem-Solving, the Computer Bulletin Board, and Geometry Fair Ideas. Laptop computers were provided at the two computer sessions. In addition to attending two sessions, teachers had the opportunity to view displays that included materials by Creative Publications, information about the Cleveland Education Fund Small Grants Program, and applications for professional conferences. The workshop concluded with a luncheon address by Genevieve Knight, who discussed the parallel issues of equity and alternative assessment methods. Professor Knight is on the staff of the Department of Mathematics and Computer Sciences at Coppin State College in Baltimore, Maryland, and serves as the director of the Mathematics Inservice Project.

Approximately 80 teachers participated in the workshop, which was held at the Holiday Inn Independence. The $C^2$ME Teachers Advisory Group (TAG) had hoped that the school district would dedicate a professional day for a citywide gathering of mathematics teachers. When it appeared that that would not occur, $C^2$ME organized the workshop, which was a paid inservice for those who chose to attend. Nine $C^2$ME members, including CPS Mathematics Supervisor and C²ME Advisory Board member Bill Bauer, collaborative Administrative Assistant Cecille Caluya, and seven CPS teachers had met on June 12 and August 19, 1989, to plan the workshops.

The evaluations of the workshop by teachers who attended were generally very favorable, although several teachers commented that there was not enough time for each session. On a scale of 1-5, with 5 representing "Great" and 1 representing "Poor," the workshop as a whole received a rating of 4.62. All but one of the sessions received ratings of between 4.10 and 4.89 on the six factors that were rated: the clarity of the purpose of the presentation, the level of interest of the information overall, the usefulness of the information, the structure of the agenda, learning new things, and the opportunity for discussion/questions. Only one factor for one session received a rating less than 4.10, and that was the Computer Graphing and Electronic Chalkboard session which received a rating of 3.80 on the opportunity for discussion/questions item--a rating that seemed to reflect the participants' concern that the sessions needed to be longer. In evaluating the workshop overall, one teacher wrote, "Everyone seemed to possess very positive feelings after having participated. I think the people here would enjoy a 'weekend retreat.' We don't need outsiders--we possess the energy--all we need is the proper environment." A second teacher commented, "Best workshop ever! A continuation of this type of activity is necessary. Teachers sharing with teachers is a great idea." A third teacher noted, "Excellent, relevant program--saw many new ideas and much enthusiasm. Thanks!" A fourth teacher said, "Pace was too fast! Much of what was covered needed much, much more time. Develop-develop-develop ideas even for teachers. If we knew, we wouldn't be here--we'd be home."

The evaluation of the workshop by the Teachers Advisory Group was also very favorable. The members felt the fact that the workshop was conducted by teachers was especially gratifying and believed it had an impact on teachers for this reason. The TAG felt that an additional benefit was that the activity provided an opportunity to share the high quality of information that is presented at the Ohio Council of Teachers of Mathematics (OCTM) Conference with teachers who are unable to attend OCTM.

A workshop on laptop computers was held on September 19, 1989, as a follow-up to the two computer sessions. The mathematics supervisor for the Cleveland Public Schools arranged for teachers to have portable computers to use at their schools.

**Model Mathematics Project**

The Cleveland Collaborative for Mathematics Education sponsored a district-wide competition, inviting high schools to submit proposals for grants of $50,000 to $75,000 to develop ways to implement the NCTM *Curriculum and Evaluation Standards for School Mathematics.* The goals of the Model Mathematics Project are: to provide school-based models of excellence in the teaching of mathematics in Cleveland high schools; to improve students' attitudes, understanding, and proficiency; to provide a "laboratory" for examining the goals outlined in the NCTM *Standards;* and to create programs that other schools can emulate. The proposals, which required a four-year commitment from each successful high school, were to be developed as a combined effort of teachers in the mathematics department, the department chairperson, and school administrative staff. Two schools were to be selected to receive four years of funding, beginning in the 1990-91 school year.

On November 6, 1989, Barbara Pence, chair of the C$^2$ME Advisory Board and vice president of administration for National City Bank, and Barbara Patterson, director of the Cleveland Education Fund, sent a letter announcing the grant program to all high school principals and mathematics department chairs, as well as to the high school mathematics teachers. On November 9, 1989, Superintendent Alfred Tutela sent a follow-up memorandum encouraging all high schools to develop a proposal. On November 27, 1989, an informational meeting was held to provide an overview of the Model Mathematics Project and to explain the two-phase procedure for applying. Representatives from 9 of the 12 Cleveland high schools attended the meeting. Phase I applications, which consisted of a three-page preliminary application, were due December 18, 1989.

A selection committee, composed of eight C$^2$ME members who were not employees of the Cleveland Public Schools, reviewed the eight proposals that had been submitted to select the schools to continue on to Phase II of the competition. On January 6, 1990, it was announced that John Adams, East, Glenville, John Marshall, and West High Schools had been invited to submit Phase II proposals. In the Phase II proposals, the schools were directed to address the following: Program Goals and Objectives, Program Description, Timeline/Party Responsible, Evaluation, Budget (itemized), Staff Experience, School Commitment, Corporate Partner's Commitment, and a Mathematics Profile of the students in the school. The staff at CEF was available to provide guidance, focus, and support to the schools as they prepared the Phase II proposals, which were due March 2, 1990. After the selection committee reviewed the proposals, the committee made a site visit to each school. As part of the visit, the teachers made an oral presentation to the committee, with a question and answer session following.

On March 30, 1990, Barbara Pence and Barbara Patterson sent a letter to the principals of John Adams and Glenville High Schools, informing them that their schools had each been selected to receive a grant of $70,000 to implement their proposals for a Model Mathematics Project. Following the letter, school representatives then came to CEF to meet with collaborative members to sign a memorandum of understanding. The participants from each school were publicly recognized at the May 24 meeting of the $C^2$ME Advisory Board.

The focus of Glenville's proposal was to develop its mathematics teachers into a team of specialists by promoting experimentation with alternative presentation styles, tools, and evaluation strategies. Each class will have a set of scientific and graphing calculators, a laptop computer, an electronic display board, and access to a mathematics computer laboratory. Teachers will assess students using a number of innovative measures, such as journal writing, portfolio presentations, creative projects, and group testing.

The teachers at John Adams will use the grant to continue to rewrite the mathematics program and upgrade courses. They are experimenting with calculators, computer demonstrations, manipulatives and cooperative learning, and alternative methods of assessment.

Dr. Richard Klein, vice president of corporate research and technology at Nordson Corporation and a member of the $C^2$ME Advisory Board, said, "The Model Schools project is an excellent example of the vitality of the collaborative effort. It was rewarding to read the many proposals for such excellent innovative ideas to enrich our schools' mathematics programs. The Cleveland Public Schools can be proud of the commitment to excellence being made by its mathematics teachers. We only wish that all the proposals could be funded. Toward that end, $C^2$ME will be working with finalist schools that were not funded to find ways to allow them to carry out their plans."

In support of the three other finalists, East, John Marshall, and West High Schools, the CEF submitted a proposal to the National Science Foundation for funding. The proposal was for a model schools program at the five schools with the $140,000 to be used as supporting funds.

Contributors to the Model Mathematics Project are Ameritrust, BP America, The Cleveland Foundation, Cleveland Public Schools, Cleveland Electric Illuminating Company, National City Bank, Nordson Corporation, and Wyatt Company. John Adams and Glenville High Schools and their corporate partners, Ohio Bell and the Cleveland Electric Illuminating Company, also have made financial commitments to the project.

## UMC Outreach Grant

Funding from EDC was procured through the UMC Outreach Action Grant Proposal program. C$^2$ME received $10,000 in funding to assist teachers in the two schools selected for the model mathematics project in their efforts to implement new assessment strategies in the mathematics education environment that they are creating.

## Dinner Symposia

### IBM Dinner Symposium

C$^2$ME presented a dinner symposium sponsored by the IBM Corporation on Tuesday, November 21, 1989, from 4:30 to 8 p.m. at the Hofbraus Haus. The event, which was designed to provide teachers with an opportunity to update their knowledge of current tools in mathematics education and share ideas on the topic with other teachers and business people, began with registration and a reception, followed by dinner at 5 p.m. The evening program began at 6:30 with a welcome by Barbara Pence, C$^2$ME chair and vice president of administration of the National City Bank. IBM Corporation Branch Manager Robert Miller introduced guest speaker Elayne Schulman. Ms. Schulman, mathematics software developer for IBM in New Jersey, presented "Math Software for the Future." Using an LCD display board and overhead projector, she demonstrated software that enabled her to graph formulas at the touch of a button, draw functions, and solve equations, which were projected from the computer monitor onto a screen.

A total of 125 people attended the symposium, including 115 collaborative teachers, 1 non-collaborative teacher, the collaborative director and coordinator, 3 representatives from IBM, 2 representatives from higher education, the mathematics supervisor, and the guest speaker. All CPS secondary mathematics teachers had been invited to participate, and the on-site observer reported that the attendance was better than had been anticipated.

In general, the teachers reported that the evening was worthwhile. On the written evaluation form, participants rated the symposium as a whole at 4.42, on a scale of 1 to 5, with 5 representing "Great" and 1 representing "Poor". Several teachers commented, however, that problems with the room set-up, acoustics, and visibility lessened their enjoyment of the presentation. Teachers also remarked that they would have liked hands-on experience, and that while the software presented seemed very useful, their schools did not have the hardware to use it. One teacher commented, "Yes, it [the symposium] was worthwhile, but we need money for the software shown. The strengths are that the symposium related how graphing can be used in everyday life, the weakness is that it was difficult to see the screen. I will try to use the graphing ideas in algebra. It will make it more interesting for the students and myself, not so abstract." A second teacher added, ". . . The location could have been better. . . . the displays were not good for people sitting in the back, also there were no handouts. There should have been more hands-on experience. If we can get the software, I will use it. I could use it in algebra." A third teacher noted, "I think that the presentation was too idealistic. All teachers do not teach in schools where this new technology is readily available. I would have liked to see more examples given for the basic students instead of just the upper-level classes. I would use the software if I had the equipment necessary to run it." A fourth teacher remarked, "Excellent symposium. It showed new technology at its best." A fifth teacher said, "The food and location were good, but the presentation was only fair. I could not see the screen, so I lost much of the impact. We should have been able to have more hands-on practice with the computer, but I realize that would be impossible in this setting." Another teacher remarked, "It would be nice if every mathematics classroom had a computer. It would be great for remedial work as well as investigative studies." The district mathematics supervisor said, "I liked it. The presentation was good and I think that it helped the teachers." The on-site observer reported, "The dinner was excellent and the presentation was very good. I was glad to see a presentation using the new technology that teachers will soon be using. I think that the teachers were impressed and were able to see what is available as far as new technology is concerned. I don't think that many of the teachers present had ever used a computer with a display panel and it was good for them to see it in action."

## Cleveland State University Dinner Symposium

C$^2$ME invited intermediate and secondary mathematics teachers to attend a dinner symposium hosted by the Fenn College of Engineering of Cleveland State University. The dinner symposium, held on Tuesday, April 24, 1990, began at 4:30 with a reception and tours of the engineering labs. Following dinner, which was served at 5:30, C$^2$ME Chair Barbara Pence welcomed the participants and then Dr. George Cowlman, dean of the College of Engineering, introduced guest lecturer, Peter J. Tsivitse, vice president of technology and corporate development at Reliance Electric Company. Dr. Tsivitse spoke on the role of high school mathematics instruction as the foundation for college-level education in the field of engineering. Approximately 60 teachers attended along with college personnel and Advisory Board members. The presentation did not meet the expectation of the teachers. The teachers had anticipated learning about mathematical applications in engineering. Instead, the speaker made general comments about the need for more engineers. Questions were raised after the symposium as to whether teachers had outgrown symposiums.

## "Teaching a Changing Population in Turbulent Times"

During Mathematics Awareness Week, C$^2$ME and the Department of Mathematics and Computer Science at John Carroll University co-sponsored a guest lecture by Dr. Uri Treisman on Monday, April 16, 1990, at 7:30 p.m. at the university. Dr. Treisman, the 1987 recipient of the Charles A. Dana Award for Pioneering Achievement in Higher Education, is currently working with the Dana Foundation to start the Dana Center for Innovation in Mathematics Education. Dr. Treisman's research on differences in methods of study among underrepresented students led to the development of The Mathematics Workshop, a program at the University of California-Berkeley, which was developed to help minority students improve their mathematics performance. In his presentation, "Teaching a Changing Population in Turbulent Times," Dr. Treisman discussed his findings regarding fundamental differences in the methods of study of several minority groups and their successes in mathematics. $C^2$ME and John Carroll University hosted a reception after the lecture, which provided teachers an opportunity to meet the speaker and informally talk with him. About 20 $C^2$ME participants were among the 60 who attended the talk. Low attendance was partly due to the fact that the invitations had been mailed at the last minute and the event was scheduled at night.

## Mathematics Clubs and Competitions

### Aetna Mathematics Club

Since 1986, the Aetna Foundation has contributed over $68,000 to $C^2$ME to help fund mathematics clubs in Cleveland intermediate schools and high schools, including $18,000 for the 1989-90 school year. Prior to the availability of grants from the Aetna Foundation, only ten mathematics clubs had been established (during the 1986-87 school year); during 1989-90, 26 mathematics clubs in 25 intermediate and high schools participated in the mathematics clubs program.

As in previous years, funds of up to $400 were granted to each of the collaborative's mathematics departments to finance the clubs. The money is used for mathematics manipulatives, field trips, software, and mathematics competitions. Grants to schools were contingent upon a commitment to participate in at least three major mathematics competitions during the school year. In addition, schools that participated in the 1988-89 mathematics club program but who did not submit a year-end report were not eligible for Aetna funding for 1989-90. Some schools chose not to participate in 1989-90.

$C^2$ME Coordinator Joe Flynn held a meeting for mathematics department chairs on Tuesday, October 3, 1989, at 3:30 in the Cleveland Foundation Conference Room, to review the status of the mathematics clubs program. Representatives from schools that did not have a mathematics club or did not participate in the Aetna program were encouraged to attend the meeting.

During the 1989-90 school year, the Aetna-sponsored mathematics clubs participated in a variety of field trips to area businesses, with some additional financial support from NSF. The informational tours provided a greater understanding both of the types of mathematics being used in business and industry and of present alternative career opportunities to students. Eighteen area businesses hosted the clubs, including Aetna Life and Casualty, Bonne Bell Cosmetics, BP America Research Center, Burke Lakefront Airport, the Cleveland City Greenhouse, The Cleveland Clinic, Centerior Energy, the National Weather Service, North Coast Cable, Progressive Insurance Company, Shore Sails Cleveland, SIFCO Industries, and WJW TV Channel 8.

After mathematics club members from Collinwood and West Technical High Schools toured the BP research facility, where they observed robotics, computer graphics, spectrographic methods and other advanced computer methods, Collinwood teacher Louis Kelsch commented, "The field trip reinforced [the students'] interest in their math and science courses and aroused their desire to continue their studies in the future."

Dr. Rudd Crawford, who has been instrumental in the NSF Problem-Solving Infusion Project, accompanied many of the mathematics clubs on their trips to get ideas for writing mathematics problems using real-world situations. The Aetna program also sponsors a city-wide mathematics competition in conjunction with John Carroll University and $C^2$ME.

## Denison Mathematics Contest

Four CPS high schools sent contestants to the annual Denison University mathematics contest, which was held on October 7, 1989, from 10 a.m. to noon. The collaborative provided transportation to Denison, which is a two-and-a-half hour ride from Cleveland.

The contest, which is very prestigious, tests students on problems from Algebra I through precalculus. A university scholarship is awarded as first prize. While Cleveland students did not finish in the top ranks, it was felt that participation in the contest was a very valuable experience.

## $C^2$ME/John Carroll Mathematics Competition

On Monday, May 14, 1990, $C^2$ME, in conjunction with John Carroll University, conducted the fourth annual Mathematics Competition for Algebra, Geometry, and Advanced Mathematics. The competition, which is underwritten by Aetna Life and Casualty, was created to encourage academic excellence, to give students positive academic experiences outside the classroom, to provide problem-solving experiences, to recognize outstanding mathematics students, to inform the public about the mathematics curriculum, to serve as a talent search for outstanding students, to encourage students to enroll in higher-level mathematics courses, and to provide students with nonathletic competitive experiences.

Approximately 500 students, forming 102 teams that represented 20 CPS intermediate and high schools, participated in the competition, more than three times the number who participated in the 1987-88 contest. The competition, which was held on the university campus, included four sections: an individual test of 30 minutes; a mental quickness quiz of 15 minutes; a mathematics relay of 25 minutes, and blockbuster problems of 45 minutes. The total number of possible points for all categories was 1,800. Each competition included problems requiring scientific calculators. Mathematics coaches were responsible for ensuring that each team member had a calculator, although programmable and graphing calculators were not permitted. The first competition began at 9:15 a.m., with registration from 8:30-9:00. Following the last event, lunch was served to all participants. After lunch, awards were presented. Each participant received a personalized certificate as an acknowledgement of his or her involvement and ribbons signifying team performance. Plaques were awarded to the first-, second-, and third-place teams in each of the five divisions, as determined by the greatest number of total team points. In previous years, only the first-place winners received recognition. Prior to the competition, the students also received a special T-shirt, which they were encouraged to wear to the contest. The competition was intentionally held during school time to demonstrate that participation in a mathematics competition was a viable reason to withdraw students from regularly scheduled classes. Up until last year, students had been excused only for athletic events.

## American Regions Mathematics League Competition

For the first time, the C$^2$ME-JCU Mathematics Competition was used to identify students to represent Cleveland in the American Regions Mathematics League (ARML) competition, which was held at Pennsylvania State University, June 1-2, 1990. Seventeen students, including 12 11th-graders participated, accompanied by coaches from Glenville, John Adams, and Audubon High Schools. Although the Cleveland team did not place, it was felt that the experience was valuable to the students and teachers.

## NSF Problem-Solving Infusion Project

In November, 1988, the Cleveland Education Fund received a four-year grant of $400,000 from NSF to develop a program to infuse problem solving into the 7th- and 8th-grade mathematics curriculum. During 1989-90, eight intermediate teachers met to consult on the project, and under the guidance of Dr. Rudd Crawford of Oberlin College, developed and pilot tested 90 five-part problem units. These teachers were given a stipend of $50 for each of the meetings. The teachers introduced the problems to their classes and conducted an evaluation of them. Units from the project may be used as individual or team activities and as a link to the problem-solving bulletin board at the Teachers' Resource Center, to the district's mathematics objectives, and to the new national mathematics standards. The concepts and methods developed and employed by the project will be disseminated nationally as a model.

Beginning on March 20, 1990, 19 teachers participated in the first of a series of teacher training workshops to help teachers use the project's problem-solving materials. The teachers met at the Cuyahoga Community College Metro campus every Tuesday afternoon for 10 weeks. In the spring, other teachers were given stipends of $600 to attend training sessions three times a week, 3:30 to 6:30 p.m., for two weeks. In the summer, another group of teachers attended a two-week training session. For the ten days, 8 hours a day, teachers received a stipend of $1,200. Training for teachers is conducted by Dr. Rudd Crawford and by Dr. Richard Little, professor of mathematics and science at Baldwin-Wallace College and a member of the C$^2$ME Advisory Board. Dr. Little is currently the facilitator of the Problem-Solving Infusion Project.

## Regional and National Conferences and Institutes

### Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for effecting local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC sponsored attendance at the workshop for two teachers from each collaborative, paying for room, board, registration, and transportation. The two teachers who represented C$^2$ME, Bill Stiggers and Robert Seitz, were selected by the TAG.

In an article that appeared in the collaborative newsletter, Mr. Stiggers wrote, "The workshop emphasized effectiveness as leaders in a school environment by means of two dimensions: understanding and communicating with people in an organizational setting and exercising organizational leadership. The workshop ended with a discussion on a plan of action in the area of equity. A group of teachers was invited to form a panel that addressed equity at the October, 1989, UMC Annual Meeting in Los Angeles."

### Making Mathematics Work for Minorities

C$^2$ME sponsored the attendance of Barbara Harris, a CPS high school mathematics teacher at the Region 1 Workshop, Making Mathematics Work for Minorities in Chicago, Illinois, November 3-5, 1989. The purpose of this project is to help reverse long-standing patterns of underachievement and underrepresentation of women and minorities in the mathematical sciences.

Participants in the workshop were representative of all areas and aspects of mathematics. The six regional workshops held throughout the United States culminated at a National Convocation held in Washington, D. C., May 3 and 4, 1990.

## National Council of Teachers of Mathematics Northeastern Regional Conference

The collaborative provided financial support for two CPS teachers to attend the NCTM Northeastern Regional Conference in Philadelphia. The conference, which focused on the NCTM *Standards*, was held November 30-December 2, 1989.

The C$^2$ME Teachers Advisory Group had agreed to support funding for four teachers--two were to have conference experience and two were not. The teachers were selected by Cleveland Mathematics Supervisor and C$^2$ME Advisory Board member Bill Bauer. At the last minute only two teachers were able to attend. One had had conference experience which the other one had not. Each teacher received approximately $600 to cover expenses.

In an article about the conference that appeared in the collaborative newsletter, Joyce Baier, a C$^2$ME teacher, wrote: "All sessions demonstrated one of the key standard goals: problem solving in action. The presenters shared ways in which they are solving some of the problems in their own situations: poor student preparation; lack of student motivation and attention; and the need to help students make connections, solve problems, and visualize. Almost every presentation I attended was practical rather than philosophical, with specific ideas for teaching. The overall impression was exciting, a radical change in the way mathematics is taught using available technology. The process is outcome-oriented, specifically fluid outcome--students knowing a way of thinking more than knowing specific thoughts. This fluid outcome will shape textbooks and standardized testing."

## Ohio Council of Teachers of Mathematics Conference

C$^2$ME offered financial support to 31 teachers to attend the Ohio Council of Teachers of Mathematics (OCTM) Conference in Zanesville, Ohio, March 23-24, 1990. Five collaborative teachers gave presentations at the conference. Each teacher received a $70 stipend from the collaborative to help cover expenses. Teachers were released from school, taking personal leave with pay. Substitute teachers were provided through the CPS mathematics supervisors' general fund. While the C$^2$ME teachers had been invited to request funding to attend, due to limited resources the Teachers Advisory Group restricted support to teachers who were actively participating in a school's mathematics department, based on a list of teachers submitted by the department chairperson. Teachers who received funding were expected to write an article for the collaborative newsletter about their experiences at OCTM.

The teachers reported that the conference was worthwhile and they seemed to appreciate the opportunity to find out what other teachers were doing in their classrooms. One teacher said, "I loved going and the meetings were good. Good speakers. . . . I will integrate it into my teaching and encourage both myself and my students to take different points of view. Hopefully it will make my teaching better." A second teacher commented, "It was worthwhile. Strengths--new techniques were valuable, mingling with college professors. Weakness--not having enough time to see presentations. I would let presenters have more than one session so that conflicts in time can be avoided. I can take the worksheets and techniques and use them in my classes. I can use the information that I saw at the exhibits." A third teacher remarked, "It was worthwhile. Strengths--seeing different points of view and talking with other teachers. Weaknesses--give us a better synopsis for the meetings. Rooms were too small for the numbers of people. It can be helpful to me if I use the information from the sessions that I attended." A fourth teacher noted, "Going to a conference on mathematics is always worthwhile. It revitalizes a teacher. . . .My teaching becomes more rich by the many experiences I've had." The on-site observer reported, "The OCTM Annual Meeting is always a good activity. There are many excellent teachers from Ohio and it is good to see them. Each of the attendees enjoyed the meeting. . . .Quite a few teachers would like to see a better description of the session. The program book only contains the title of a talk and a very brief description. Sometimes the session and its description do not match."

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Four C$^2$ME teachers received collaborative funding to attend the 68th Annual Meeting of the NCTM in Salt Lake City, Utah, April 18-21, 1990. CPS teacher Robert Seitz also attended, with funding from the UMC Documentation Project. The theme of the conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened to address new challenges in professionalism and make a new commitment to mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The work session on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, MA, whose address was titled "Students of Color Through Staff Development."

The collaborative awarded a travel grant of up to $600 to each teacher to help cover expenses. The teachers were selected by the Teachers Advisory Group. Only teachers who attended OCTM were eligible to apply for funding.

The teachers who went seemed very excited about having had the opportunity to attend the conference and about the sessions they had attended. In an article that appeared in the collaborative newsletter, CPS teacher Marie Klein wrote, "Attending the OCTM and NCTM annual meetings is one way to maintain the levels of professionalism and enthusiasm needed to make every day--every lesson--count for our students. . . .Being professional includes keeping up with new or redeveloped classroom techniques. . . . Overall, these conferences provided me with a heightened sense of my professionalism as a teacher and renewed my enthusiasm for mathematics education. I returned with the conviction to convince my students that learning mathematics takes no special ability. I agree with Iris M. Carl, President-elect of NCTM, that 'only to claim that we did what we could while students who can learn fail to learn, is unacceptable.' As Lola May stated: 'We must be careful not to be in teaching, but rather into teaching.' I am into teaching mathematics--enthusiastically, successfully and as a professional."

## Cleveland Mathematics Teachers' Resource Center (MTRC)

The Cleveland Mathematics Teachers' Resource Center of $C^2ME$ was established at the Metro Campus of Cuyahoga Community College in October, 1985, as a clearinghouse for information and a meeting place for Cleveland public school teachers. The MTRC, which is open from 3:00 to 6:00 p.m. Monday through Thursday, provides a variety of services to mathematics teachers, including a centrally located meeting place, a monthly calendar of events, a data base on teachers, computer access, an electronic bulletin board system which is used by over 100 schools/individuals, and desktop publishing facilities. The MTRC serves as the hub of the district's curriculum development and inservice training and the site of several collaborative events, including meetings of the Teacher Advisory Board. The MTRC is also a center for the collection, review, and distribution of materials. It provides consultation services and distributes a list of recommended materials to each department chair in order to encourage mathematics departments to obtain supplemental textbooks, supplies, and materials, including calculators, to help teachers implement an activities-based approach to mathematics instruction. On Monday of each week during the school year 20 problems are posted on the electronic bulletin board--one problem for each day of the week for each of four levels, primary, intermediate, junior high and senior high. Students entered their responses on the bulletin board, then staff of the Center provided feedback to those responses.

During the 1989-90 school year, the MTRC was staffed by Roger Muenger (Manager), Bill Stiggers (Assistant Manager), and Gretta Orazen. Roger Muenger, a CPS teacher for 21 years, has worked at the Mathematics Teachers' Resource Center since it opened in 1985 and helped to establish the electronic bulletin board. Bill Stiggers, a CPS teacher for 19 years, has served on the MTRC staff for five years. Gretta Orazen, a second-year CPS mathematics teacher, joined the staff of the Resource Center this year.

## Small Grants Program

$C^2ME$ provided consultation and assistance to mathematics teachers who applied for grants from the Small Grants Program of the Cleveland Education Fund. This program was established to support innovative projects that enrich and strengthen the learning experiences of Cleveland public school students. By providing seed money for instructional experimentation, the fund makes it possible for educators, parents, and students to put imaginative ideas into practice. Many of the approved projects are subsequently infused into the curriculum.

Applications are reviewed for both educational content and originality; projects that are given priority have potential implications beyond the grant period, are interdisciplinary, and include a parental involvement component. Applicants are required to submit a project description that sets forth the goals of the project, the proposed program, its duration, and the results and method of evaluation, as well as a projected budget. Grants may be used to purchase equipment or provide field trips as components of a larger project, but cannot be used for tuition or to pay public school personnel. A brief evaluation and expense report is mandatory within one year of the grant award.

During 1989-90, the sixth year of the small grants program, the Cleveland Education Fund received 500 proposals and awarded 130 grants totaling $55,856 to encourage creativity in the classroom. Grant awards ranged from $64 to $536, with the average grant at $430. As in previous years, only projects with educational content were considered. The three deadlines for submitting requests were October 10, 1989; January 10, 1990; and April 10, 1990. Awards for mathematics-related projects maintained previous levels, with 22 in 1987-88, 23 in 1988-89, and 19 in 1989-90. Of these proposals, 11 were at the elementary level; 4 at the intermediate level, and 4 were at the high school level. Mathematics-related projects funded by small grants during 1989-90 included "Evaluation and Measurement," "Motivation with Manipulatives," "Math Motivators and Manipulatives," "The Electronic Toolkit," "Informal Geometry," and "Hands-On Magical Math." In addition, an intermediate school mathematics teacher received a $500 small grant to implement a Math Lab project.

The recipients of Small Grants awards were honored at the annual dinner of the Cleveland Education Fund, which was held on June 5, 1990. In a letter of invitation to the Small Grant winners, CEF Grants Administrator Maria Usalis wrote, ". . . you are the people with the ideas, the enthusiasm, and the extra effort it takes to make learning more interesting and exciting for your students. We hail each of you as persons willing to go that extra mile. The children in your classrooms are indeed fortunate to be enriched by such special people."

## Teacher Scholarships

As part of its commitment to C$^2$ME, the Department of Mathematics at John Carroll University continued to offer tuition scholarships to mathematics teachers in the Cleveland Public Schools. Scholarships cover tuition for university mathematics courses, ranging from introductory calculus and statistics to graduate courses in the department's Master of Arts and Master of Science programs. Two awards were made for the summer of 1989 and one award was made for the summer of 1990.

## C$^2$ME Newsletter

The collaborative distributed two newsletters to teachers and Advisory Board members during the 1988-89 school year--one in the fall and one in the winter. The newsletter announces events, programs, and contests; recognizes teachers for personal accomplishments and C$^2$ME participation; and prints articles written by teachers who have attended professional meetings and conferences as well as reprints of articles of interest to mathematics teachers.

The newsletter is prepared by a Newsletter Committee of four teachers who review and edit the articles and see that photographs of events are included. In early November, the committee sent a survey to all mathematics teachers requesting input regarding the type of information to include in the fall/winter issue of the newsletter.

In addition to the newsletter, in March, 1990, the Cleveland Education Fund initiated publication of the *Collaborative Update.* This monthly bulletin lists opportunities for professional development that are available in the Cleveland area, especially for teachers of English, science, and mathematics.

## E. Observations

### Project Management

The management structure for $C^2$ME has evolved into a smoothly functioning organization that depends on the cooperation of teachers, representatives from business and industry, representatives from higher education, the mathematics supervisor, and those from the Cleveland Education Fund. The commitment of the Advisory Board members to the collaborative is evident in their record of attendance at Board meetings and other collaborative activities. Respect for the collaborative on the part of those from the corporate world and higher education is reflected in their support of mathematics education in the area and their initiation of the mathematics model project through the Advocacy Committee. That the collaborative has attained such stature is related to several important factors.

One factor is the regard that Cleveland has for the Cleveland Education Fund and the ability of CEF to draw upon the greater Cleveland community in supporting the public schools. The reputation of CEF attracts people from local corporations and institutions of higher education who participate actively in what it does. CEF has also provided consistent administrative support to the collaborative. During the five years of its existence, the $C^2$ME has experienced as many changes in coordinators as any of the other collaboratives. Even with these changes, however, the collaborative has continued to receive the administrative support it needs because of the active involvement of CEF and its director. The collaborative is operated out of CEF's office. The director of CEF serves as the primary fund raiser for the Fund and the mathematics collaborative. She feels very responsible for assuring that the collaborative has the support it needs. Among the fund-raising principles she adheres to are: making certain that contributions and applicants feel a sense of ownership in CEF projects, giving recognition to those who contribute, providing regular funding of new initiatives, and persistence. She believes that the ideal budget needed to operate the collaborative is $100,000 per year; however, the collaborative could function with a minimum of $50,000, 40 percent for administrative costs (including program personnel) and 60 percent for program. Having a director who assumes the major responsibility for fund raising has meant that the Advisory Board has not had to devote large amounts of time to fund-raising activity. This has not been the case in all collaboratives.

A second factor in Cleveland's investment in the collaborative is that representatives of business and higher education have been involved in the activities of the collaborative from the very beginning and feel ownership in what it does. They also are convinced that the collaborative is serving a worthy purpose and that the contribution of their time is of value. This is the result of a recognition on the part of the collaborative leadership that unless those from business and higher education who serve on the Advisory Board are actively engaged in its activities, they will soon lose interest and find some other way to use their time. The Advocacy Committee was formed for this particular reason--to enable its corporate and academic constituencies to define the contributions they wished to make. There also have been efforts on the part of the mathematics supervisor and teachers to educate this group on issues of education reform in mathematics, new materials available for the teaching of mathematics, and the barriers that teachers face in attempting to deal with the constraints on their professional development and collegiality.

A third factor that has contributed to the success of the $C^2$ME has been the existence of the national UMC network. The collaborative director has identified this as one of the differences between the mathematics collaborative and other collaboratives operated through the fund. The active national network has helped to empower individual teachers. The fact that they know and are able to call on people from across the nation has contributed to their sense of autonomy and independence. This gives teachers the feeling that the collaborative is a discrete organization, relatively independent of the CEF--the CEF is viewed simply as the fiscal agent for the collaborative. One teacher active in $C^2$ME expressed the importance of maintaining this identity after the termination of Ford Foundation funding. He recognizes that if the collaborative is to maintain this independence, it is important for the teachers and others to have direction and to know what projects are to be sustained. He has a sense that for the collaborative to obtain funding, it is necessary to put it "in a new package and give it a new direction."

Certain issues have been raised about the management of the collaborative. One is that the coordinator now serves both the science and the mathematics collaboratives. Some teachers view this arrangement with suspicion and wonder if the mathematics collaborative receives the attention it should. However, others feel that having one person coordinate both collaboratives works well--that it provides an opportunity for collaboration between the two groups, although this had not been achieved by the end of the 1989-90 school year.

Another issue is that of increasing the number of teachers who are actively involved on committees and other forms of leadership in the collaborative. The group of teachers who serve on the Advisory Board and TAG have devoted time and energy to the collaborative. Other teachers, about 70 percent of the intermediate and secondary mathematics teachers, participate in activities but are not willing or do not have the time to devote to collaborative leadership initiatives. One business representative felt it was important for the collaborative both to reach teachers other than the "cream" and to be able to generate converts. Active collaborative teachers recognize the importance of reaching a greater number of teachers. One strategy has been to sponsor an inservice in August before school begins. What is needed in terms of activities devoted to expanding the number of participating teachers is some strategy that will develop leadership capability among teachers who are willing to help guide the collaborative and expand the inner core of dedicated teachers.

Overall the collaborative seems well positioned to address the important issues facing it and to further mathematics education in the area. The active commitment of those from the business and higher education sectors is a very strong component of the C$^2$ME. This along with an active core of teachers and a highly respected mathematics supervisor gives the collaborative a strong foundation from which to significantly impact mathematics education in Cleveland.

## Collaboration

C$^2$ME has successfully engaged members of the corporate world and those from higher education in collaboration with teachers to advance the mathematics education program in Cleveland schools. A major form of collaboration has been in the governance of the collaborative. Other forms include site visits, mathematics contests, presentations, institutes, and projects such as the NSF Problem-Solving Infusion Project. One important by-product of this collaboration is the formation of a group from business and higher education who feel strongly about working with and supporting teachers. The Advocacy

Committee is one example of such a group. Professors and teachers working on the problem-solving project is another example. One reason for the evolution of this form of collaboration has been the leadership and initiative exercised by the chair of the Advisory Board, the directors of the CEF, the mathematics supervisor, and a few from higher education. Another contributing factor has been the focus provided as a result of the consistent emphasis on problem solving as a major theme for the collaborative. Another factor is the leadership of a group of teachers who have been willing to serve on committees and develop activities for other teachers. Those from business and higher education have been impressed by the commitment of these teachers and are consequently willing to make greater time commitments of their own. The collaborative director has noted that those from business who serve on the Advisory Board have gained respect for the teachers. ". . . that respect had to be earned over a period of time at these meetings with people actually sitting down together . . . business people seeing that teachers had good ideas . . . teachers seeing that business people were interested . . . a perfect setup." It was this process of learning to collaborate that she identified as one of the three most important outcomes of the collaborative. Another factor, as has been noted above, is that the mathematics supervisor and teachers have spent time in educating those from other sectors in the new trends in mathematics education and how new ideas need to be applied in the classroom.

The Model Mathematics Project has generated some opportunities for collaboration during 1989-90. The parameters of the program were defined and funds raised by CEF and the Advocacy Committee. When a team composed of members of the collaborative not associated with the schools visited the schools to hear presentations on the proposals, some team members were in fact visiting schools for the first time since the collaborative's beginning. In very few of the collaboratives have people from business and higher education come to schools to hear presentations by teachers. This approach helps to break down the barriers that exist among the different groups as a result of having those from the other sectors experience the conditions of classroom teaching and what the teachers face each day.

The concept of advocacy is important in Cleveland and is seen as a critical contribution of the collaborative. Cleveland is described as "a political town." The mathematics supervisor notes this and the importance of broad support: ". . . you need people from outside the district to support you. We need to work harder to make those people who are big power brokers in the city to have political savvy for our benefit. We need to have the teachers and the business community talk." Advocacy represents a more advanced stage of collaboration than simply providing resources or attending meetings because it requires an understanding of the educational system and the direction that those in the program want to go. Advocacy is a pro-active rather than passive means of effecting change.

Another impact of $C^2ME$ has been the increase in collaboration and interaction among teachers within mathematics departments. The collaboration among mathematics teachers has helped to develop a different environment for teaching and is having some impact on students. One reason for this has been the Model Mathematics Project, but greater collegiality among mathematics teachers was developing before this program was initiated. One middle school teacher noted a change at her school, "There is a difference in the school atmosphere since before the collaborative. You could measure the improvement because of the collegiality factor. There is a definite increase in the number of kids taking higher level courses and a decrease in the number of kids who are failing. . . .Teachers feel good about themselves . . . a sense of fellowship."

Those from higher education have contributed to the collaborative by providing expertise and support. Summer institutes have been conducted on local campuses, contests have been conducted at John Carroll University, and professors are working with teachers on the problem-solving project. The involvement of those from higher education has been motivated by their desire to be helpful, but some university personnel have also benefited by using their association with the collaborative as one supporting factor when writing proposals for grants. Thus, collaboration has been initially beneficial to both teachers and those in higher education.

There are several challenges facing $C^2ME$. One is how to expand the number of teachers willing to be active in the collaborative. There are some very active mathematics departments in the collaborative--departments in which a large percentage of teachers are collaborative participants. In other departments, the presence of the collaborative is being felt in increasing the interaction among teachers. However, there still are a number of mathematics teachers, well over half, who may attend one or two collaborative activities but who do not assume any ownership or responsibility for what the collaborative does. The Model Mathematics Project is directed toward furthering the work among teachers in two school mathematics departments. One important contribution, and a challenge, for this program is to develop a long range strategy that will build on the work of the two selected departments in extending the impact of the collaborative to all of the mathematics teachers in Cleveland.

One business representative active on the Advisory Board has been impressed by teachers and what they do, "These people (teachers) have my respect. They really put it on the line." He sees that a successful collaborative will benefit all. He hopes that one of the outcomes will be a better-informed student body, more knowledgeable about mathematics. But he cautions against thinking that the same expectations have to be applied to teachers that are applied to those in business who have to design or sell a specific product. He notes, "We need to understand that (teachers) don't always need to be task oriented, as business people tend to be." He has valued his work on the collaborative. He does feel that meetings at 4:00 p.m. do not really give people the opportunity to get to know each other. This happens in more informal settings--at a party or golf outing. He implies that those from business, higher education, and the schools have become acquainted and are in a position now to really get to know each other if given the right settings. Even without this, he recognizes that the collaborative has made great strides towards people "learning to respect each other's perspective."

One other issue raised by $C^2$ME members is that of cooperation between the mathematics collaborative and the science collaborative. Even though both have the same coordinator and are housed at CEF offices, there has been little interaction between the two efforts. The two collaboratives differ some in purpose. The science collaborative has focused more on curriculum development while $C^2$ME is more directed toward the professional development of teachers. $C^2$ME tends to view itself as an independent organization. The science collaborative has specified priorities that guide its objective of having as many science teachers knowledgeable about science as possible. The $C^2$ME has shown more interest in supporting teachers' participation in professional meetings and operating the resource center. Both persons from higher education who were interviewed felt that the mathematics and the science collaborative should do more with each other. One noted that science provides the most important examples for motivating the learning of mathematics. The other felt that if the two collaboratives joined then mathematics and science teachers would interact more with each other. There appears to be some rivalry between the two collaboratives, but there also seems to be the potential of working on joint projects that could benefit both groups. There was some attempt to set up a joint program involving C$^2$ME and the writing collaborative during the 1989-90 school year. Initial planning was done on P.S. Write (Problem-Solvers Write), a project with the objective of introducing writing into mathematics.

## Professionalism

Intermediate and secondary mathematics teachers feel that the collaborative has enhanced their professional lives, especially as a result of the support system developed by the collaborative for mathematics teachers. A greater number of teachers have assumed leadership roles and become active in decision making within their schools, within the district, and in professional organizations. Teachers have also become more active professionally--attending meetings and participating in other professional development experiences. The work of the collaborative has sometimes been carried out so smoothly in conjunction with that of the mathematics supervisor that the two become indistinguishable. In one sense, this is an indication of the extent to which the collaborative has become embedded in the district.

The collaborative has provided a support system to teachers in many ways. The different projects that have engaged teachers within departments have helped to encourage mathematics teachers to work together. For example, as a result of the initiative of the mathematics supervisor, middle school teachers have been working on a calculator project that is funded partially by the collaborative. Teachers have also gotten to know each other better through attending conferences and symposiums, and working on committees.

Some of the progress that has been made can be attributed to the work of individuals who have gone out and recruited others, encouraging them to become actively involved. One teacher who had only occasionally attended collaborative programs noticed the teachers who were active in the collaborative: they were taking advantage of some of its resources, bringing materials back from its events, and using them in their classes. Overhearing talk in the teachers' lounge regarding the new ideas circulating added additional pressure. This teacher had already felt that he was an outsider because he was not a mathematics major, as are a number of mathematics teachers in Cleveland. The collaborative teachers began showing him some of the latest ideas in mathematics education and demonstrating the use of the computer. He contrasted this with what it was like before the collaborative, ". . . we were free to try things but we didn't know the possibilities . . . [now] we are encouraged to try things and we feel comfortable doing them . . ." Some of the peer pressure had its effect on him, ". . . when you see four or five guys doing things there isn't any reason not to try." One of the outcomes of the collaborative for this teacher was that for the first time in 21 years of teaching, he went to the Ohio Council of Teachers of Mathematics meeting. For this teacher, the collaborative has greatly reduced his isolation, "I enjoy coming into work after 21 years because of the influence of the collaborative. You can feel alone in that classroom [but] you are not alone. You have backup all over the place. . . Help is always there. Nothing that you used to dread can go wrong now."

At the same school, a 22-year-old was in his first semester of teaching. He was fearful of teaching in an inner city school, but was pleasantly surprised that a city school could be run in an orderly fashion and that the mathematics department could be so supportive. He had received help from so many of the teachers that he could not imagine wanting to teach any other place. Even though these two teachers are from the same school--a school with one of the most active mathematics departments in the collaborative--stories of teachers at other schools confirm that this increased feeling of support within the school and among other mathematics teachers is not restricted just to this site. A teacher, also a non-mathematics major, spoke of the collaborative as being like a family, "I do not feel bad about calling anyone about how to solve a class or math problem."

The Mathematics Teachers' Resource Center continues to provide a service to teachers that is another factor in the support the mathematics teachers feel they have. The Center is teacher operated. The problem-solving bulletin board provides a means of accessing all schools through electronic mail. It takes time and effort on the part of the teachers who work in the Center to develop the problems, give feedback on responses to the problems, and maintain a data base on those who use the bulletin board. The Center also provides a meeting place for mathematics teachers and those who provide assistance when needed. The Center is stocked with materials, books, and software. Teachers can call the resource teachers with questions or inquiries. The resource teachers will then respond, sometimes researching the best solution to their needs.

In addition to the fact that teachers have a greater sense of being supported, a few teachers are also assuming leadership roles. The two resource teachers at the Center are one example of this. Others include the teachers who are working on the Teachers Advisory Group, the Advisory Board, and the Program Committee. An increase in leadership activity has also been apparent in some mathematics departments, as demonstrated by the two departments who received grants through the Model Mathematics Project. But even though demonstrated leadership has remained confined to less than a fourth of the teachers, other teachers have become more involved in decision making than was the case prior to the existence of the collaborative. One active teacher who has assumed a leadership role in $C^2ME$ reported the growth of professionalism as one of the three outcomes of the collaborative. ". . . there is just a change in how [teachers] see themselves. We used to think of ourselves as isolated, concerned about classroom control. Now we are seeing ourselves as presenters."

Active members of the collaborative are concerned about engaging more mathematics teachers in what the collaborative does. One attempt at this was the "Teachers-by-Teachers" workshop in August. This reached a greater number of teachers than some school year activities because there was not as much competition for their time. Other strategies need to be developed that will continue this effort. There are still teachers to reach, such as the one who observed, "We have so many responsibilities we don't know where to fit [the collaborative] in . . . You have to weigh the value. Will the change be worth the headache and the push beyond the call of duty that will be needed in order to make a change or will it be less if I continue to do my job the way I've been doing it for years and years?"

The close collaboration with those from business provides some insight into teaching and how teachers are viewed. One engineer, when asked to compare a teacher with someone in his company, expressed his sense that a teacher is most like a manager of a small research and development group. "[The manager] has a lot of demands to be selling, influencing, and converting people. . . . He sets direction and constantly coaches his people to keep them on target . . . taking people and convincing them this is a great idea. He has a vision and is working on it." Clearly this person has a high regard for teachers and what they do. The collaborative has helped him to experience teachers in this way as professionals. He admits that his involvement has been rewarding to him, "I've enjoyed doing this and getting an appreciation for the kind of things [teachers] have to deal with

. . . parents . . . kids. . . .[It has been] pretty rewarding to me to get to know them."

**Mathematics Focus**

The C$^2$ME has had a significant impact on mathematics education in at least some Cleveland schools. Principals at two schools reported observing improvements in student test scores that they attribute at least in part to having teachers involved with the mathematics collaborative. One principal's goal is "to get inside the classrooms and improve the instruction and make kids active participants in their own education." He reported that more students were taking higher level mathematics courses and that fewer students were failing mathematics classes. He describes the collaborative as a ". . . program that makes a teacher feel like a professional, gives her/him an opportunity to interact with other professionals . . . . to bring quality ideas back to the classroom is going to make that teacher a better teacher and the quality of education better." An active collaborative teacher noted some changes she had made because of the collaborative and how these changes had affected her students, "I've gotten the student involved in ways I would have never guessed. Ideas I've picked up from the collaborative . . . manipulatives, problem-solving units on cubes, and cube trays. Kids said, 'This is math?' When you do something that is not numbers, the lost kids get interested." The director of the CEF also noted that the teaching has improved a great deal. She reports, ". . . some schools now have two-period algebra, more students are turning in homework, there is better attendance in classes, more people are taking higher-level mathematics classes, and the teachers are enthusiastic."

The major mathematics focus of the collaborative has always been problem solving. This is seen in the problem-solving bulletin board, the problem-solving projects, the work with calculators, and the institutes that have been provided for teachers. With the publication of the NCTM *Curriculum and Evaluation Standards*, in which problem solving is one of five primary goals, the collaborative was in position to take full advantage of this impetus. Members of the Advisory Board were instructed on what was in the *Standards* and why NCTM and others were supporting them. A chair of the mathematics department at a local university, and member of the Advisory Board, wrote a one-page letter in support of the *Standards* that was distributed by the collaborative. One of the business representatives commented that the *Standards* made sense. It is out of these beliefs that the work of the Advocacy Committee came to focus on the *Standards*. There is real doubt that had the collaborative not existed, the *Standards* would have received the attention they have in Cleveland.

Other ways that the collaborative has influenced the mathematics education climate in Cleveland include: conducting mathematics contests, supporting the development of mathematics clubs, and supporting the Mathematics Teachers' Resource Center. These forces along with the presence of a very active mathematics supervisor have resulted in an aroused group of teachers and the implementation of a number of forward-looking programs.

## F. Next Steps

Many opportunities for professional development will be available for $C^2$ME teachers during the summer of 1990. Several Cleveland teachers will be participating in the Cleveland Teachers' Internship Program, working as interns in the private sector. The Oberlin Teachers Academy is offering Summer Institutes beginning in June, 1990, one of which is the Project to Increase Mastery in Mathematics (PIMM). As part of the Problem-Solving Infusion Project, which was funded through an NSF grant to the collaborative in 1988, a series of workshops encouraging 7th- and 8th-grade mathematics teachers to use the project's problem-solving materials will be held at Baldwin-Wallace College in July, 1990. Participating teachers will have the option of receiving either a $1,200 stipend or four graduate credits. Two mathematics teachers, identified by the $C^2$ME Teachers Advisory Group as potential leaders, will be attending the EDC Leadership Conference in New Hampshire in August, 1990. Twenty Cleveland teachers, 10 mathematics teachers and 10 science teachers, have been invited to participate in a National Association of State Boards of Education Symposium that will be hosted by Case Western Reserve University in August. The symposium is a major national leadership symposium for the chairs of state boards of education.

In September, 1990, Glenville and John Adams High Schools will begin to implement their proposals with funding through the Model Mathematics Project. Both schools received a four-year grant of $70,000 from C²ME in a district-wide competition to develop and implement state-of-the-art curriculum and instructional materials and methods that reflect the NCTM *Standards*. Three other finalists in the competition, East, John Marshall, and West High Schools, submitted their proposals for model mathematics programs to CEF, which in turn submitted a proposal for their support to the National Science Foundation for funding. NSF granted the collaborative $307,000 in October.

The collaborative has received $10,000 in funding from EDC for projects to develop alternate forms of assessment to accompany the model curriculum that will be implemented through the Model Mathematics Project grants.

Plans are being made to obtain a multiuser system to handle the large volume of calls on the mathematics electronic bulletin board sponsored by the Mathematics Teachers' Resource Center. Over 100 schools/individuals use the network, including some from suburban schools.

Plans for the 1990-91 school year include the continuation of on-going programs in the collaborative, including the Resource Center, mathematics clubs and competitions, symposia and workshops; sponsoring attendance at professional conferences; offering internships and teacher's scholarships; and the publication of the collaborative newsletter. The application deadlines established for the 1990-91 Small Grants Program are in October, December, and February. Tentative plans for future activities include: teacher-to-teacher workshops, job shadowing, mathematics fairs, and visitations to university classes.

C²ME is also planning a project called P.S. Write in cooperation with the new, locally-funded Cleveland Writing Collaborative. The project will help elementary teachers use student writing to diagnose and evaluate the thinking techniques students apply to mathematics problem solving.

# SUMMARY REPORT
# DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the progress and activities of the Durham Mathematics Council (DMC) during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Durham Mathematics Council to the Ford Foundation for continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

# DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

## A. Purpose

Since September, 1988, the Durham Mathematics Council has been committed to a three-year plan to reform mathematics education through teacher empowerment. In keeping with this plan, DMC activities until 1991 will strive to foster professional independence and to establish the means by which the organization will become self-supporting. In particular, activities will be designed to encourage and stimulate teachers to effect change in both mathematics curricula and methodology, thereby empowering them to assume responsibility for their professional practices and growth.

The Phase III proposal, submitted to the Ford Foundation in May, 1988, specified objectives for activities of three types: out-of-school, in-school, and networking. Guidelines required that activities be teacher-generated, flexible and innovative, and inclusive of all mathematics teachers.

The objectives of the out-of-school activities are:

1. To motivate teachers to become involved in professional activities;
2. To provide opportunities for teachers to learn what is occurring nationally in mathematics;
3. To provide teachers opportunities to examine mathematics programs outside Durham;
4. To provide growth opportunities for teachers as mathematicians; and
5. To empower teachers with the responsibility for effecting change and strategies for doing so.

The objectives of the in-school activities are:

1. To assist teachers in implementing new methods and topics in their teaching of mathematics;
2. To help foster collegiality among members of mathematics departments in the schools; and

3. To provide teachers with materials necessary for the effective teaching of mathematics.

The objectives of the networking activities are:

1. To counteract the isolation normally experienced by mathematics teachers;
2. To provide an opportunity for mathematics teachers to become informed about how other mathematicians apply their knowledge;
3. To educate non-teachers on needed changes in mathematics;
4. To develop collegiality among area mathematicians and mathematics teachers; and
5. To provide special opportunities normally found in other professions to teachers.

In achieving the reform of mathematics education through teacher empowerment, it is expected that the three types of activities will occur simultaneously rather than sequentially. Out-of-school activities will serve as the catalyst for mathematics reform. In-school activities spur that reform and transform it from ideology to action. Networking activities, which foster collegiality among teachers and area mathematicians, provide professional support as well as resources to mathematics teachers working toward mathematics reform. The Durham Mathematics Council serves 41 mathematics teachers from the Durham City Schools and 86 from the Durham County Schools.

## B. Context

The Durham Mathematics Council serves a metropolitan area of approximately 180,000. The City of Durham itself had a population of approximately 135,000 in 1989. The city and county maintain separate governments and responsibilities, and the two school systems in the area operate independently of each other. About half of the County schools are situated within city boundaries.

The economic conditions in the area are reflected in an unemployment rate in Durham County of 2.6 in 1989, down from 3.3 percent in 1988. Out of a labor force of 103,000, 2,700 were unemployed. There has been an infusion of new industries in the area. General Electric Aircraft Divisions, for example, announced plans to establish a new manufacturing plant in Durham. The plant, representing an investment of $120,000,000, will make aircraft engine components. When fully operational in the mid-1990s, the plant is expected to employ 500 to 800 workers. However, some large companies have announced plans to close their City of Durham plants; among these are Erwin Mills and American Tobacco Co. GTE has transferred some employees to other locations. The withdrawal of major industries and personnel shifts will have a long-term impact on the city tax base and has already caused a sharp rise in property taxes.

A merger of the City and County School Districts has been rejected by voters four times during the past 20 years. The proposal has been revived within the past year and must survive a series of reviews before it can again appear on the ballot for approval by voters. A 41-member task force appointed to review the merger issue delivered its final report to the County Board of Commissioners in May, 1989. The report urged the commissioners to take the plan to the voters. A merger of systems would attempt to address: (1) the disparity in the number of black students in City Schools as compared to the County, (2) the high City Schools dropout rate, and (3) overcrowding in the County system. After the plan for merger is developed and approved by both school boards and the County Commissioners, the merger could be entered as a voter referendum in 1991.

In February, 1990, the County Board of Commissioners hired the consulting firm of Stanton, Leggett and Associates for a fee of $126,000 to conduct a study on merging the two school systems. The study is to involve two phases: In the first phase, the consultants will gather information and make recommendations regarding the proposed merger and its possible impact on educational improvement. During the second phase, plans for the structure of the merged district will be prepared. The firm's proposal outlines three criteria for the merger of the two systems: (1) improvement of the educational program for all students, (2) the soundness of the move economically for both City and County residents, and, (3) the benefit to the entire area.

## The Durham City Schools

The Durham City Board of Education has five elected members. In February, 1989, Dr. Hawthorne Faison, former executive assistant superintendent of schools in Milwaukee, Wisconsin, was chosen as the new superintendent of Durham City Schools. He assumed his post on April 1, 1989, signing a four-year, $85,000 per year contract. Dr. Faison has said that he plans to be active in visiting schools and talking with teachers, students, and administrators. In addition, he has asked the school board to evaluate his performance regularly. Among the new initiatives that Superintendent Faison plans to institute is a team of specially trained instructional leaders to work with three schools that had low test scores and other problems. His plan for an alternative school for students with social and behavior problems is already in place.

The Durham City School Board reviewed a $52,100,000 preliminary budget for 1990-91 that represents a 10.8 percent increase over the 1989-90 budget of $41,300,000 and proposes to double the amount the County pays to supplement teachers' salaries. The state is expected to provide a 6 percent, across-the-board increase to teachers for the upcoming year. The City Schools' working budget proposes an additional 5 percent salary increase, at a cost of $860,000, to be paid out of County funds. Teachers were promised a 10 percent raise in 1989, but in fact only received half of that. Budget projections included $240,000 for the purpose of hiring two new mathematics and science teachers, as well as four new special education teachers, a new attendance counselor, a school psychologist, and secretary. A proposed $9,700,000 of the budget would be reserved for standard maintenance and improvement of school buildings. An additional $3,800,000 is targeted toward major renovations of five school buildings and construction of a new elementary school and a new high school. A new computer laboratory has also been proposed. Although in 1986 $18,600,000 in building bonds for City schools were voter-approved, the city has spent $2,900,000 of the $5,600,000 in bonds issued thus far. A new mathematics and science wing at Durham High School and repairs at other schools were financed through the bond. The City Schools spent approximately $2,406 (of local funds) per pupil in 1989-90.

The Durham City School district consists of 20 schools: 13 elementary schools, 4 middle schools, 2 senior high schools, and an alternative school. There are 8,200 students in the City Schools, an enrollment that represents a 39 percent decrease since 1970. At the high school level, there are 1,948 students; there are 1,696 middle school students, and 4,557 elementary students. The high school ethnic population is: 95 percent (1,851) black and 5 percent (97) white. At the middle school level there are 93 percent (1,577) black and 7 percent (119) white students. State education officials have identified four all-black schools in the City. Overcrowding in some schools has necessitated the use of trailers as portable classrooms.

In 1989, the State of North Carolina published a report that cited the Durham City Schools for the highest truancy and dropout rates in the state for the third year in a row. Academic problems and truancy were the major reasons listed for the dropout numbers, followed by substance abuse. The average daily truancy rate was more than 15 percent in 1988-89. During 1989-90 at the high school level, the annual dropout rate was 11.5 percent. In addition, more than 50 percent of the system's students drop out before graduating, with an 11.5 percent annual dropout rate per year. The state has a requirement that students be dropped from school after 10 days of unlawful absence.

Elementary students in Durham City Schools achieved lower scores on the California Achievement Test (CAT) in 1989 than in 1988. Scores for Durham City Schools, released in July, 1989, revealed that 23 of 39 classes that took the tests in April of that year scored lower than the same grades did the year before. Middle school classes, however, showed improvement over the previous year. Three-quarters of the 12 middle school classes tested scored higher than in 1988. In 1989, City 8th-graders averaged in the 41st percentile on the CAT compared to their 35th percentile rating in 1988. North Carolina students scored at approximately the 77th percentile on the CAT, based on national norms. City students averaged 706 on the combined verbal and quantitative scores of the SAT testing program in 1989, compared to the state average of 836. Three units of mathematics are required for high school graduation; Algebra I, Algebra II, and Geometry are required for an academic diploma. A total of 1,500 students were enrolled in mathematics courses during 1988-89. Sixty-five percent of the graduating students continue with a postsecondary education.

In 1989-90, Durham City Schools employed 17 secondary teachers and 24 middle school teachers who teach mathematics. Currently, 60 percent (25) of the city's mathematics teachers are female and 66 percent (27) black. In 1988-89, annual salaries ranged from the state base of $18,330 to $30,430, plus the local supplement from the Durham City Schools of $400 to $2,000. City teachers receive the same pay raises as County teachers. Thus, the minimum salaries should reach $20,500 by 1991-92. Each City teacher received 15 paid inservice days during 1989-90.

In an effort to curb the dropout rate, four Durham City middle schools have been targeted for the Glaxo, Inc., Challenge Program. Students who sign up for the program will have tutors and mentors during the spring semester. Students will be challenged to attend school everyday, improve their grades, commit to the program, and remain free of drugs and alcohol. Students who complete the challenge will be eligible for a victory celebration hosted by Glaxo.

The Durham City School District was one of 29 North Carolina systems that failed to meet the new statewide accreditation standards. Based on a trial run of the new program designed to measure how well schools are educating students, Durham City Schools ranked third from last of the state's 134 systems. City schools met only 40 percent of 21 student achievement standards and was the only Research Triangle (Raleigh, Chapel Hill, and Durham) area system to fail to meet requirements. To become accredited, school systems must meet 75 percent of the performance and opportunity standards mandated by the state Board of Education. These standards set minimum test scores, attendance, and dropout rates.

The Durham City Board of Education is considering lowering high school graduation credit requirements. The system currently offers two diplomas: an academic diploma that offers college preparatory courses, and a general diploma for students who have not decided on a particular vocational direction. Under the plan, students who obtain a general diploma would have to complete 20 credit units compared to the 22 units currently required. Students in the academic diploma program must complete 23 units to graduate. The State of North Carolina requires 20 credit units for graduation.

Durham City Schools is offering an alternative school for students who have behavior problems, poor attendance records, or are socially maladjusted. Accommodating 50 students (25 middle school and 25 high school students), the alternative program will offer classes in mathematics, social studies, English, music, and physical education. Students returning from state correctional facilities spend a month or more at the school as an adjustment period before being admitted to City high schools. Most students placed in the alternative school are expected to stay for one semester. It opened in October, 1989, at the Walltown Elementary School site after a $45,000 renovation had been completed.

During the 1989-90 school year, Robert G. Wilson, a 7th-grade mathematics, science, reading, and electives teacher, was named Durham City Teacher of the Year. He won the award as a result of innovative ideas he was using in his mathematics class. Mr. Wilson received a $1,000 check in the Gold Star Award program initiated in 1986 by Central Carolina Bank to support excellence in the Durham County and Durham City Schools.

### The Durham County Schools

Five elected members serve on the Durham County Board of Education. County Superintendent Dr. Larry Coble resigned in the spring of 1989. The new superintendent, Dr. Jerry Weast, was hired during the summer of 1989 at an annual salary of $92,000. School funding and the proposed merger of the Durham City and County districts are top priorities of his administration. Judy Smith, a former chemistry teacher, was named in July, 1989, as mathematics/science coordinator for Durham County schools. Other announced priorities were equity in the schools and a total reorganization of the County Schools administration. Dr. Weast has proposed a $123,000,000 plan to renovate and expand facilities in Durham County Schools. The three high schools in the district would be renovated at a cost of $28,000,000, and another $1,000,000 would be added to the construction funds for the new $19,600,000 high school being built. So far the County has spent $28,500,000 of the $38,700,000 allocated for repairs and additions in area schools. An additional $800,000 would be earmarked for buying land for new elementary schools. Three new elementary schools opened in September, 1989. In addition, the package calls for over $90 million worth of elementary and middle school renovations and construction. The County system has 97 trailers that are used for classrooms, 42 at the elementary, 14 at the middle school, and 41 at the high school levels. Some of the trailers are over 30 years old. The building plan would replace them with permanent structures. Construction is to begin during the summer of 1990 and is expected to be completed by the summer of 1993. In addition to renovation, Dr. Weast cited several goals pertaining to raising academic standards in the district, including increasing parent involvement, upgrading classroom equipment, raising standardized test scores, increasing the attendance rate to 95 percent, reducing the dropout rate, improving school cafeterias and school lunch programs, hiring and retaining top level employees, and improving employee salaries and working conditions. The plan was endorsed by the Board of Education and Dr. Weast was commended for his report. The Durham County Board of Education approved the budget and sent the package to the County Board of Commissioners.

The Board of Commissioners rejected requests from both the City and County Boards of Education for building and renovation funds. Instead, the board proposed a lower figure to put before the voters on a bond referendum to meet requests from the City and County Schools. The County Schools District, which had asked for $122,000,000 would receive about $66,500,000 under the referendum.

The 1990-91 budget for Durham County Schools was approved at $111,600,000, an increase of approximately $2,400,000 over the 1989-90 budget of $109,200,000. Thirty-five percent of the school budget comes from local resources, 61 percent from the state, and 3.5 percent from federal funds. Since 1986, Durham County has spent $28,500,000 for repairs and additions to system schools, out of the $38,700,000 allocated in a bond initiative passed by voters that year. A master building plan for the future details $30 million for construction and renovation and a $1,000,000 addition to a new high school being built. A recent audit identified course offering discrepancies that cannot be addressed until facility inequities have been eliminated. Renovations of administrative offices and a new lobby at Southern High School were contracted by the Durham County School Board.

The Durham County School System encompasses an area of 275 square miles. The Durham County system is comprised of 24 schools: 15 elementary schools, 5 middle/junior high schools, 3 senior high schools, and 1 special school. Recent redistricting, due to overcrowding, resulted in the opening of two new elementary schools during the 1989-90 school year. Approximately 18,500 students attended County Schools during the 1989-90 school year, including a large number of County students who now live within the city limits due to city annexation. Enrollment in the district has increased by 1,500 students since 1984 and is projected to increase by another 1,500 by 1994. Durham County student enrollment has increased by 36 percent since 1970, and is expected to double by the year 2,000. Currently, 64 percent (11,782) of the student population are white, 33 percent (6,104) are black, .02 percent (369) are Asian; and the balance (128) is from other ethnic groups. During 1989-90, 14 percent of the student population received free or reduced-cost lunches. The average daily truancy rate for Durham County Schools has held steady at 6.13 percent for the last two school years. The County Schools spent $2,430 per pupil in local funds in 1989-90. During 1987-88, the per-pupil spending overall was $3,629, 30th in the state of 140 systems.

Approximately 4,900 students attend the County's middle and junior high schools. Sixty-nine percent are white and 31 percent are black. North Carolina requires that the California Achievement Test (CAT) be administered to 3rd-, 6th-, and 8th-grade students. Median total battery/national percentile scores were 71, 65, and 62 respectively. In addition, Durham County also tests students in grades 4, 5, and 7. County 7th-graders averaged in the 68th percentile on national norms, compared to the 54th percentile statewide average. The elementary school population totals 8,950. Four thousand five hundred students in the district attend senior high schools. Seventy-one percent are white and 29 percent are black. Less than one percent have English as a second language. The combined average SAT scores, verbal and quantitative, for the 80 percent of the 1989 graduating class at Durham County high schools who took the test, was 871, 32 points lower than the national average of 903 and 35 points above the state average of 836. In mathematics, County Schools seniors averaged 456 compared to 476 nationally and to 439 for the state. North Carolina has the lowest state average in the nation. Out of 1,158 graduating seniors in County Schools, 912 (80%) took the SAT. Comparatively, the state participation average is 57 percent while 40 percent of seniors nationwide take the test.

The County Schools graduate 77 percent of their students, and about 82 percent of these go on to post-secondary education. The annual dropout rate in Durham County Schools is approximately 7.5 percent, according to North Carolina Department of Public Instruction reports released in June, 1990. Graduation requirements currently include two units of mathematics, but that total is being increased to three units for 1992 graduates. Approximately 80 percent of high school students take mathematics courses each year. On the average, students take more than three mathematics courses during their high school career. Any student who meets all course requirements for graduation but fails to pass one of the four sections of the required competency test may receive a GED certificate in lieu of a diploma.

During a trial run of a new accreditation standards and ranking program for all North Carolina schools, the State Department of Public Instruction found that Durham County schools met 95 percent of the requirements for accreditation. Systems that meet 75 percent of the requirements may be accredited.

The Durham County School system employs 1,312 certified staff. Two hundred eighty-seven high school teachers are employed by the district. Eighty-four percent (240) of high school teachers are white and 15 percent (44) are black. Forty-three percent of total certified staff have post-graduate degrees.

Durham County high schools employ 40 mathematics teachers. Seventy-three percent are women and 27 percent are men; 78 percent are white, and 22 percent are black. Thirteen of the teachers hold a master's degree and 27 hold a bachelor's degree. All of the high school mathematics teachers in Durham County are certified to teach mathematics, and 63 percent are tenured. Forty-six teachers teach mathematics in County middle schools.

During the 1989-90 school year, the 10-month base salary for North Carolina teachers was $19,810 for beginning teachers with a bachelor's degree and no experience, and topped out at $37,060 for teachers with a master's degree and 29+ years of experience. A doctorate certificate guarantees a base of $22,100 for employees with no experience and reaches $38,910 for employees with 29+ years of experience. Local systems supplement base pay. Durham County provides annual 10 percent supplements paid in December and May. In 1989, the North Carolina Legislature approved a bill that provides an average six percent pay increase for teachers. Teachers were placed on a new 30-step salary schedule that, depending upon experience, provides raises of up to 15 percent over three years. The base salary will be augmented by $2,200 and reach a starting salary of $20,500 by 1991-92, when the schedule is expected to be fully in place. With respect to teacher salaries, North Carolina has for the past two years ranked 34th nationally, a drop from its former rank in the 29th position. There is no teachers' union in the Durham City or County districts and teacher contract negotiations do not occur in the State of North Carolina. However, lobbying of the state legislature on educational issues and teacher salaries has been carried on by the North Carolina Educational Association.

Career contracts are given to employees who have performed better than "at-standard" during their first three years with Durham County Schools. Probationary contracts are awarded to teachers in full-time permanent positions who have not achieved "career" status.

The new superintendent of Durham County Schools has proposed a 5th-grade center in Durham at American Tobacco's former Blackwell Street plant. The center, which would be supported by both the County and City Schools systems, would provide all 2,500 5thgraders in the area with a one-week exposure to science, computers, and technology. The week would also focus on specialized instruction in mathematics and science. The Durham Chamber of Commerce has assured Dr. Weast, Durham County Schools, and Dr. Faison, Durham City Schools, that business and industry will support the center. Duke University, North Carolina Central University, and members of the Durham business community have expressed willingness to provide support for the project. Although teachers would accompany children to the center, actual instruction would be handled by experts in mathematics and science from business, industry, and the universities. Teachers would have the opportunity to interact with these experts to develop follow-up classroom materials. One hundred children per week are projected to attend the center over a 30-week period. A proposal seeking $750,000 in seed money was submitted to RJR Nabisco as part of a national competition to participate in the company's Next Century Schools Program. The proposed Durham Center 5th-Grade project is a finalist in the competition.

County 1st- and 2nd-graders are being evaluated qualitatively in a new assessment program in mathematics. The new program is designed to accompany an instructional program that emphasizes problem solving and mathematical reasoning. It also stresses communication as a bridge between the concrete manipulation and symbolic manipulation of mathematical knowledge. Under the assessment procedure, students will be required to participate in mathematical experiments, graphing visualization, and exercises requiring verbal solutions to mathematical problems.

## State Support of Education Initiatives

The state's Basic Education Plan has recently come under fire since many schools have had trouble meeting its requirements. The Plan, an $800,000,000 program begun in 1984, is an attempt to ensure that all students in North Carolina have an opportunity to obtain the same minimum education. It provides funds to school systems that enable them to hire teachers to reduce class size and offer courses--such as advanced mathematics and science, arts, and foreign languages--that they could not otherwise afford. In addition, the Basic Education Plan provides merit pay for teachers in the 16 schools that serve as models in the pilot program. Several superintendents and principals feel that in the pilot schools the school day has become fragmented, especially in elementary grades, as children are diverted from regular classes for instruction in music, arts, or foreign language. The program is overwhelmingly opposed by members of the North Carolina Association of Educators, an affiliate of the National Education Association--a professional organization for teachers.

In October, 1989, when state SAT scores were made public, State Superintendent of Public Instruction Bobby Etheridge announced a five-point program aimed at improving secondary education. Etheridge pointed out that the decline in test scores occurred after 8th-grade, indicating that the problem lies in the secondary schools. The program calls for directing more students into higher mathematics courses and for more rigorous courses in English, history, and science. Further recommendations included encouraging high school systems to devise merit pay plans that would reward teachers for good results.

The state plans to grade public school systems by comparing the performance of their students. The report card will include student scores on the CAT in reading and mathematics as well as the North Carolina tests for science, social studies, and writing at the elementary levels. Comparisons among secondary schools will include state examinations in algebra, biology, history, geometry, and chemistry. SAT scores and percentages of students passing state competency examinations in reading, mathematics, and writing will also be used.

In 1986, a University of North Carolina task force recommended raising the test score requirements above the 35th percentile for student admission to teaching programs. During 1989-90, the state Board of Education agreed to consider the recommendation, which would affect the state's 43 teacher education schools. The number of students who are projected to fail the admissions test, if the UNC task force recommendations are adopted, would climb to 8 percent overall (34 percent for blacks) in communications and to 12 percent overall (47 percent for blacks) in general knowledge. The Department of Public Instruction recommended that the passing score on the admission examination be raised from the 4th percentile to the 6th percentile in communications, and from the 2nd percentile to the 12th percentile in general knowledge. Currently, 17 percent of all students fail the teacher exit examination statewide. All prospective teachers at the University of North Carolina, who graduate after July, 1991, with K-9 certification (for grades K through 6 and grades 6 through 9) will be required to have a double major, in education and in a content area. Since 1988, education majors have been required to have an overall Grade Point Average of 2.5 on a 4.0 scale. Results of the National Teacher Examination show that 90 percent of UNC graduates taking the examination passed.

A study by the Southern Regional Education Board in Atlanta, Georgia, indicates that more than 8,000 teachers from underrepresented groups are needed in North Carolina to balance the ratio of minority teachers to minority children. The percentage of black teachers in North Carolina fell from 21.2 percent in 1978 to 17.9 percent in 1988. The shortage of black teachers is most acute in the fields of chemistry, physics, and mathematics. The North Carolina School of Science and Mathematics is striving to acquire more qualified minority applicants. Minority students now total about 15 percent of the student body, according to Director John Friedrick. A summer program has been suggested both to maximize the effect of the teacher-training programs conducted on campus each summer and to acquaint students with the school.

The University of North Carolina (UNC) system has 130,000 students; in 1989, more than 7,500 needed remedial help with courses at a system cost of $3.2 million. Mathematics, science, and English tutoring were offered. As a result, in the fall of 1990 new UNC system admission standards will become effective that will require high school students to pass 12 courses in English, mathematics, science, and social studies.

Federal funding for school spending dropped from 14.2 percent in 1972 to 7.7 percent for the 1987-88 school year. State spending has remained at approximately 69 percent while local spending has increased from 19 percent to 23 percent. The decline in federal funding and inconsistency in state funding has placed a heavier school finance burden on local resources, which has created a disparity between districts with significant financial resources and those without. A yearlong study by the Public School Forum of North Carolina on how the state finances its schools will be presented to the 1991 legislature with recommendations for future spending.

## Professional Development Opportunities for Teachers

In July, 1989, the Durham Public Education Fund's (DPEF) Board of Directors named Jennifer McMillan as chairman of the Fund. DPEF is a non-profit, tax exempt organization seeking to improve the quality of education in Durham City and County

Schools by fundraising efforts that target the private business sector, foundations, and individuals. During the 1989-90 school year, six grants of up to $500 were made available to Durham elementary teachers through the Fund's Teacher Initiative Grants Program. In 1989-90, the Fund awarded six Teacher Initiative Grants of $500 each to elementary teachers in the Durham City and County Schools. Among the recipients was an elementary school teacher who received a grant for "Cooperative Learning Through Math," a project designed to enhance student interest in mathematics through parental involvement, mathematics workshops, and coaching. The grant program was started in the fall of 1988, with the awarding of two $500 grants.

The Durham Public Education Fund received a $22,000 donation from Mitsubishi Semiconductor America, Inc., to finance a program that would help middle school students apply textbook lessons to real experiences. The "Mitsubishi Middle Schools Grants Program" will support teams of teachers interested in providing students with field trips that would build on or extend the impact of classroom instruction. The program's objectives are to develop students' enthusiasm for learning, to help students understand concepts and processes, and to instruct them in the importance of cooperative team activities. Thirteen teams of Durham area middle school teachers in all content areas have been selected to receive grants from the program. The $300 grants were awarded for projects that involved students in an integrated curriculum in fields such as mathematics, social studies, and science. So far, Mitsubishi Semiconductor America, Inc., has committed $155,000 for public school education purposes in the Research Triangle area.

Additionally, the DPEF was awarded $20,000 by the Z. Smith Reynolds Foundation in Winston-Salem to start a community-wide development campaign this spring and to expand a staff development program for Durham educators. The grant will enable the Fund to expand the teacher enrichment program begun last spring. Five of the Research Triangle area's largest corporations and Duke University are hosts of the program. It is designed to train educators to develop motivation and leadership skills and to deal with personal stress and conflict management.

An education breakfast held in November, 1989, co-sponsored by the Durham Herald Company and the DPEF provided an opportunity for the award of the first Glaxo Teaching Chairs in Science to two science teachers. Glaxo, a pharmaceutical company, presented $3,000 and a plaque to each teacher. Joseph Martin, a brother of Governor

James Martin and guest speaker at the breakfast, noted, "Education is an art form that occurs during magical encounters between teachers and students."

The Mathematics and Science Education Network of the University of North Carolina and the North Carolina Department of Public Instruction are sponsoring teacher inservice training, including a series of summer institutes for mathematics and science teachers of grades K-9. The Mathematics and Science Network, created in 1984 to meet the need for improved mathematics and science instruction, is composed of nine teacher-training centers and a research and development center, each housed at a constituent institution of the University of North Carolina. A strong emphasis of the program is on science and the participation of underrepresented teachers. Public school teachers who participate in the summer programs are paid a stipend of $35 per day for each full day of attendance. Courses range in length from two to five weeks. Tuition, fees, textbooks, and materials are provided free of charge.

The Semiconductor Research Competitiveness Foundation, along with IBM, DuPont, and the Microelectronics Center of North Carolina, sponsored Summer Project '89, a five-week summer program for teachers. The project is designed to establish an ongoing dialogue between industry and secondary teachers. Sixteen teachers, including two collaborative teachers from Durham High School, Joan Robinson and Pat Morris, participated in the program. In addition to the summer program, the foundation planned a recruitment program for science and mathematics teachers in 16 North Carolina counties. It also offered summer camps for high school students, promoted science and mathematics clubs in schools, and developed a program to encourage parents to participate in their children's school work and career plans.

## Regional Information

Durham is one of 15 cities in the nation participating in a science education project designed to help black churches encourage black youth to pursue careers in science and mathematics. The program, sponsored by the American Association for the Advancement of Science, is funded by a $220,000 grant from the Ford Foundation. Church members will receive training from project coordinators to provide after-school mathematics and science workshops, science and mathematics career days for families, and science-related outings to museums, zoos, and other institutions.

RJR Nabisco will spend $30 million nationwide to promote radical classroom change. First preference for funding will go to North Carolina. Up to 60 schools will eventually receive three-year grants of $100,000 to $250,000 per year to pay for the experimental programs.

The local Environmental Protection Agency staff (located in the Research Triangle Park) has been named as a first partner in the newly created Durham Public Education Partnerships program. The program matches a business, educational organization, or civic group with a public school. Employees of the organization will go into schools to tutor, mentor, and hold special programs and teacher training. The project, which began in January, 1990, is a joint effort of the Durham City and County School Districts and the Durham Chamber of Commerce.

## Semiconductor Research Competitiveness (SRC) Foundation

The Semiconductor Research Association is a non-profit coalition of about 50 companies in the field whose mission is to increase the business of members. This association operates the SRC Foundation. The Foundation supports work done at universities, gives scholarships to minorities, and works with K-12 programs to encourage students to go into the semiconductor business. A Durham City teacher was a recipient of one of the SRC Foundation grants for its Fellowship Program for the summer of 1990. The program, to run from June 27 to August 10, is designed to provide a meaningful summer experience for mathematics and science teachers that will increase the effectiveness of their relationships with industry. Another goal of this program is to assist classroom teachers in enhancing the curriculum in ways that will increase the effectiveness of their classroom presentations.

The competition was open to secondary (grades 7-12) mathematics, science, and technology teachers in school districts within commuting distance of the Research Triangle Park. Among the benefits to fellowship winners were three graduate credit hours and a $3,000 stipend. The competition was publicized in the collaborative newsletter and applications were available through the staff development office in each school district. During the 1989-90 school year, Joan Robinson participated for the second time in the SRC Summer Fellowship Program.

## C. Development of the Collaborative

Several changes took place in the administration of the Durham Mathematics Council (DMC) during 1989-1990. The Durham Mathematics Council operates out of the North Carolina School of Science and Mathematics (NCSSM), a state-funded residential high school for academically talented 11th- and 12th-grade students. The DMC was located in the suite of offices assigned to the Outreach Division, formerly called Special Programs and Research. The executive director and secretary for the DMC are considered employees of NCSSM. Beginning July 1, 1989, John Friedrick, formerly the director of the Science Academy in Austin, Texas, assumed the position of director for the NCSSM, replacing Charles Eilber. Mr. Eilber had served as director for the school since its founding in 1979. Dean of Special Programs and Research Dr. Keith Brown served as the project director of the DMC until March 28, 1990, when he left the NCSSM to take a position with the North Carolina Department of Community Colleges. As project director, Dr. Brown oversaw the general activities of the collaborative and attended to fiscal matters and long-range planning. In May, 1990, William Youngblood, who for half of his time is the principal of NCSSM, assumed the responsibilities of the dean of Special Programs and Research. Mr. Youngblood serves on the DMC Board of Directors. The operation of the DMC continued to fall under the jurisdiction of the Special Programs and Research. Dorothy Doyle, director of the Mathematics and Science Education Center and member of the DMC Board of Directors, will serve as interim project director until the beginning of the 1990-91 school year, at which time Dr. Jo Ann Lutz will assume responsibilities as project director for the DMC.

Helen Compton, who had been the executive director of the DMC since June, 1988, resigned in June, 1989. A search for her replacement began during the summer, culminating in the appointment of Vivian Leeper-Ford to the position in October, 1989. Ms. Leeper-Ford, a mathematics teacher at Hillside High School in the City of Durham, had served on the DMC Board of Directors since 1985. She has taught in the Durham City

Schools for nineteen years. Special arrangements were made with the administration of Durham City Schools that enabled Ms. Leeper-Ford to continue to teach 60 percent time--three mathematics classes--and to spend afternoons working for the collaborative. Ms. Leeper-Ford's contract as DMC executive director was not renewed in June, 1990, due to unanticipated shortfalls in the budget.

Ms. Leeper-Ford in recent years has received special recognition on several occasions. She was named a Woodrow Wilson Fellow in the summer of 1989, attending a four-week algebra institute held in Princeton, New Jersey. She was one of fifty selected out of over 1,000 applicants nationwide. After the institute she was assigned to one of the traveling teams of four teachers to give five one-week summer institutes during the summer of 1990. In August, 1989, she attended the UMC Teacher Leadership Workshop held in Newton, Massachusetts. In May, 1990, Ms. Leeper-Ford attended the National Convocation of the Making Mathematics Work for Minorities project of the Mathematical Sciences Education Board in Washington, D.C. In June, 1990, she was one of three teachers honored at a luncheon held in Raleigh for recipients of the North Carolina Presidential Award for Excellence in Secondary Mathematics Teaching. In April, 1989, Ms. Leeper-Ford spoke to members of the business community at a DMC breakfast hosted by IBM. In her talk, she referred to the Durham Mathematics Council as a close personal friend. She concluded her remarks by reflecting, "One of the main reasons that I have continued to teach is that I am an avid learner. And that is why I began my remarks by referring to DMC as a personal friend. DMC makes me stretch myself!"

The executive director is assisted by a full-time secretary, Barbara Davis, who maintains DMC records, contacts teachers, and oversees the use of the Resource Center. Many of the responsibilities of the executive director were met by Ms. Davis in the interval between the departure of Ms. Leeper-Ford and the return of Dr. Lutz as the director. Ms. Davis began working for the DMC in October, 1985, and has provided continuity for the Council during the transition of executive directors. Betty Peck, a retired mathematics teacher from the County School district, is the on-site observer. A total of 127 middle school and high school mathematics teachers in the Durham City and County School systems are served by the DMC and are encouraged to participate in its activities.

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## Affiliation with the Durham Public Education Fund (DPEF)

During the year, the Council chairman explored the wisdom of a DMC affiliation with the Durham Public Education Fund. The DPEF, founded in 1986, had continued to grow and now seemed to be stable enough to serve as an umbrella agency for raising funds on behalf of the collaborative. On March 21, 1989, Tony Habit became the first executive director of the Fund.

The Durham Public Education Fund was founded in 1986 to foster a commitment to public education by the private sector. The Fund, a non-profit corporation, was established to enhance the quality of education in Durham's public schools by serving as a broker between industry and schools. The Fund works with the City and County Schools in administering programs in instruction, enrichment, student support, and professional development for educators. The goal of the Fund is to expand curriculum offerings by developing corporate foundation and individual monetary support. Changes in the DPEF in 1989 included increased community support from $48,000 in 1988 to $250,000 in 1989 and an increase in Board membership from 17 to 28 members. Jennifer McMillan, the director of public affairs for Glaxo, Inc., was named chair of the Board of Directors of the Durham Public Education Fund, Inc. Ms. McMillan, the first board chair from the private sector, has served as a member of the Education Fund's Board of Directors since its inception in 1986.

In 1988, the Fund initiated more than $200,000 worth of projects, including expanded training opportunities for teachers, recognition of exceptional educators, and a government-studies program for students. The Fund launched a $300,000 fund-raising campaign for 1990. One fund-raising effort, "Step Out for Education," used volunteers to provide information to owners and managers of small businesses about the goals of the DPEF. At least 20 teachers each from the City and County Schools joined volunteers from area businesses, the Chamber of Commerce, and Duke University in visiting businesses to solicit funds. The plan was to raise $50,000 from 600 businesses in the Durham area for expansion of a teachers' grant program. This effort was not as successful as planned and raised only approximately $10,000. At the beginning of the 1990-91 school year, the DPEF had received only $1,000 specially designated for the DMC.

The general plan for affiliation was for the DMC to remain associated with and housed in the NCSSM. At the same time, the Council was to turn over much of its fund-raising responsibility to the Fund. Members of the Council's Board of Directors would help with fund raising. A proposal describing this plan was distributed to the DMC Board of Directors in December, 1989, by the chair, Dr. Michael B. Bunch, of Measurement Incorporated. The plan was approved by the Board at its January meeting. There was some informal discussion between the chair of the DMC Board of Directors and the DPEF Board. At one time, the amount of the DPEF grant to DMC was expected to be $30,000. In further discussion, it was reduced to $15,000 in April. By the end of the 1989-90 school year, there was some question as to whether the DPEF would have any money to give DMC. Affiliation with the DPEF would mean that all approaches regarding fund raising would have to be made through the DPEF. In preparation for affiliation, the Council was to clearly define its financial goals, needs, and resources and provide this information to the Fund for its spring fund-raising campaign.

At its March meeting, the DMC Board of Directors voted to make Tony Habit, executive director for the DPEF, one of its members. At the May 8, 1990 meeting of the DMC Board of Directors, Tony Habit's representative, Mary Holderness, reported on the DPEF and its fund drive. Members of the DMC Board of Directors and the DMC staff helped the DPEF in its drive to raise $300,000. Mr. Habit attended his first meeting of the DMC Board of Directors in June and announced that the "Stepout for Education" fund-raising drive fell far short of its goal. As a consequence, it was not clear what DPEF funds would be available for the coming year. At the end of the school year, the relationship between DPEF and the DMC had not been clearly defined because the DPEF was not sure of its funding.

Some difficult questions were being asked at the end of the 1989-90 school year about the permanent structure of the collaborative and the most appropriate institution to host it. The Durham Mathematics Council over the year was affected by personnel shifts among a number of influential people. These included the changes in the DMC project director and executive director, the director of the NCSSM, and the superintendents of the two school districts. In part because of these changes, not everyone viewed the future of the DMC in the same way.

Mr. Friedrick, the new NCSSM director, was left with the impression by the school's previous director that the DMC would eventually be hosted by the school district. It was not until he met with the DMC Board of Directors at their March meeting that he received the clear message that the DMC wanted to continue its association with NCSSM. At the end of the school year, the DMC was still housed at the NCSSM. The office and Resource Center was relocated in a cottage adjacent to the main building to provide greater access to those facilities for those who came from off-campus. In addition to space, the NCSSM continued to provide administrative service for the collaborative and assigned Dr. Lutz to spend part of her time as the project director. Housing the DMC is aligned with an important outreach initiative of the school.

At the beginning of the 1989-90 school year, some members of the DMC Board of Directors were exploring the possibility of the DMC becoming more closely associated with the Durham Public Education Fund. This did not seem as viable an option by the end of the school year because of the difficulty the DPEF had in raising funds, as noted above, and because of the question regarding the amount of funding it could contribute to the DMC.

The two school districts each acquired new superintendents. Both of them raised questions about the relationship of his school district to the collaborative.

The County superintendent decided that the district's mathematics supervisor could provide a program comparable to the Council's and did not want to renew the district's pledge of $10,000 for 1990-91. The City superintendent did not agree to provide a fixed amount of money, but to contribute what the district could, given its budget constraints. In the summer this was still being negotiated, thus adding another issue to be addressed by the DMC in the future.

During 1989-90, different options for hosting and financing the DMC were explored. In the end, the NCSSM continued to support the Council and provided the Council a place of residence. Other alternatives such as locating the Council at the DPEF or in one of the districts did not seem reasonable at the time.

## The DMC Board of Directors

The governing structure of the Durham Mathematics Council is considered distinct and separate from its administrative structure and each has specific responsibilities. The dual structures were established in order to create an efficient and effective operating collaborative, with the executive director serving as the main bridge between the two organizations. The main decision-making body is the Board of Directors. This group is scheduled to meet every other month, but meets more frequently as needed, to set policy, oversee fund raising, and allocate funds. The Steering Committee, which consists of at least one teacher from each school, creates ideas for programs, develops activities, and is assuming an increasing role in implementing activities.

The Board of Directors, chaired by Dr. Michael B. Bunch, met eight times (seven regularly scheduled meetings and one unofficial meeting) in 1989-90. The Board began the school year with 18 members including 2 teachers (1 from each district), 10 representatives from local businesses, 3 representatives from higher education, 2 school district mathematics and science coordinators (1 from each district), and 1 NCSSM representative. One representative from higher education resigned from the Board in January because of illness, bringing the total number of board members to 17. This position was filled by Tony Habit, the executive director of the Durham Public Education Fund. From 11 to 13 of the members attended the meetings along with Ms. Leeper-Ford, Barbara Davis, and occasional guests.

Each meeting began with the introduction of guests or new members. This was followed by committee reports and a report by the executive director. The executive director reported on the activities held since the last meeting, the level of participation by teachers, information requested by the board from previous meetings, and her concerns for the next year. Following the reports, the board discussed and voted on motions raised during the meeting.

The main topics discussed during the year were the affiliation of the Council with the DPEF and its continuing relationship with NCSSM. At the January 8, 1990 meeting, Dr. Brown's last, the members passed a motion to begin negotiations regarding affiliation with the Durham Public Education Fund. Revised grant-funding guidelines and by-laws were approved at the February 15 meeting. At the March 28 meeting, the group voted to have the DPEF executive director fill the vacant board position and requested that the chair contact both of the superintendents about their expectations for DMC and their interest in serving on its Board. The main action of the Board at its May 8 meeting was to direct Ms. Leeper-Ford to prepare a report on the participation level of teachers and on the DMC's impact on Durham teachers.

At the June 12 meeting, a subcommittee was formed to assist Ms. Leeper-Ford in gathering this data. Further discussion of the participation level of teachers and their use of the Resource Center was held. A board member expressed a desire that the DMC consider how to better address the district's staff development needs. He emphasized the importance of measuring the Council's success in improving student performance and the need to include elementary teachers. The latter idea was rejected by the collaborative's executive director who noted that the Council will take steps to include elementary teachers when Ford Foundation funding has ended. Until then it was important to adhere to the proposal as submitted to the Ford Foundation. The chair of the Finance Committee reported that an error had been found in the 1989-90 budget and that instead of having a $59,000 carry-over, there was only $10,283. The members became concerned and began thinking of cost-cutting measures.

On June 19, Dr. Bunch, chair of the DMC Board of Directors, recommended to the director of the NCSSM that the position of executive director of the Council be eliminated for 1990-91 because of the unanticipated budget shortfall of $20,000. In a letter to the Board of Directors, June 22, Dr. Bunch reported that he had taken action with the approval of the Executive Committee of the Board to eliminate that position. In a July meeting with Mark Driscoll and Brian Lord from EDC, it was determined that in fact there was not a shortfall, providing $15,000 from DPEF and the contribution from the Durham County Schools was received. In July, funds from these sources were still in question. Subsequently, the director's and executive director's positions were consolidated into a project director's position filled by Dr. Jo Ann Lutz, as a contribution of the NCSSM.

The four committees of the Board of Directors are the Advisory Committee (Dorothy Doyle, NCSSM, chair), the Finance Committee (Thurman Dortch, North Carolina National Bank, chair), the Publicity Committee (Clay Swenson, GTE, chair), and the Nominating Committee (Marie Eldridge of Howard, Perry, & Walston Realtors, chair). All of the committees meet generally as needed. The most active committee is the Advisory Committee which has responsibility for allocating grant funds. Members of this committee are on the Board of Directors and include both the City and County Schools systems representatives and mathematicians from local businesses, research institutes, and universities. The committee works closely with the executive director. This committee met on February 13, May 8, and June 12. At other times, the chair conducted the business of the committee via telephone contact with members. During the year, the Advisory Committee approved 31 (20 in Feb and 11 in June) grants and denied 1 request. On March 9, the Finance Committee met to discuss the relationship of the Council with the NCSSM and the DPEF.

The Publicity Committee chair in January reported on its development of a public service announcement to be aired over a local television station. The chair, along with Barbara Davis, attended a workshop on how to use free television air time to advantage. There were no further reports from the Publicity Committee during the year because of the absence of its chair from the Board of Directors' meetings. The Nominating Committee proposed extending the basis for membership on the Committee from the pool of Board members serving their final year to any Board member. The Nominating Committee will continue to be chaired by the vice chair of the Board of Directors. This move was approved by the Board at its February meeting. The approved by-laws also included the establishment of an executive committee consisting of the chairman, vice chairman, Council executive director, chairman of the Advisory Committee, and a representative from the host agency.

### Steering Committee

The Steering Committee is composed of at least one representative from each of the 16 City and County middle and senior high schools. Sixteen teachers are members of the Committee along with the executive director. During 1989-90, the Steering Committee met five times--November 15, January 9, February 20, March 20, and May 15. Meetings were held in a NCSSM conference room at 6:30 p.m. on Tuesdays. Attendance at the first four meetings ranged from six to nine. At the May meeting, only three school representatives attended. Three teachers listed as members of the Steering Committee did not attend any of the five meetings. At its first meeting of the school year, Ronn Seiber, Neal Middle School, agreed to chair the group for the year.

In the Steering Committee meetings, time was spent on organizational matters such as choosing a chair, designating a member to take notes, and others to attend to other tasks including the newsletter; plans for future activities; suggestions for activities that should be initiated; and discussion of other business brought before the group. The group felt there was a need for a mathematics fair and for mini-conferences to provide an opportunity for those who attend a conference to tell others about their experience. At its November meeting the group urged that ways be found to work with elementary teachers. When told at the February meeting about the possible affiliation with the Durham Public Education Fund, teachers expressed concern that this arrangement was being forced to ease the responsibility of the Board for raising funds. Some teachers did not like the idea that their interests were being represented by someone who was not a teacher, in this case by the NCSSM representative on the Board of Directors' sub-committee.

At the February meeting, the low attendance at the subject area meetings of the networks was discussed. Ms. Leeper-Ford asked the school representatives to encourage teachers to attend. Plans to have a mathematics fair in April were dropped because there was not enough time to plan. Other topics on the agenda included the Collaborative Leadership Conference to be held in August in Durham, New Hampshire; ways to increase the involvement of local businesses in the collaborative; and a statistics workshop, to be presented by Cheryl Brothers, a teacher from the Tidewater Council of Teachers of Mathematics in Virginia, scheduled during the week prior to the beginning of the school year. Topics discussed in March were the Eisenhower grants and ways to collaborate with the Math Science Education Center, course offerings that could be provided through the NCCU mathematics department, the menu for the April 24 dinner meeting, information on other future activities, and proclaiming DMC day for April 24.

The group of five attending the May meeting, including the executive director and the on-site observer, received a report on a meeting Ms. Leeper-Ford had with Dr. Bunch and the two superintendents, which implied that the Council's success would depend on involving a greater number of teachers. The mini-conference scheduled for May 19 was canceled because of the low number of preregistrations. Ms. Leeper-Ford reported on the conferences she had attended--the National Convocation for Minorities in Mathematics in

Washington, D.C., and Writing in Elementary and Middle School Mathematics. The meeting closed with the group discussing plans for the next year. The group felt that there was a need to survey teachers to find out what they wanted. One hope was that the DMC would focus more on its original goals of increasing the professionalism and self-esteem of mathematics teachers. Suggestions were made on how to increase the participation of teachers, such as having a public relations campaign, increasing the teachers' awareness that their participation is important to the DMC, mailing DMC newsletters to teacher's homes, and designating a specific day each month for DMC activities.

## D. Project Activities

The Durham Mathematics Council offered a variety of activities to mathematics teachers during the 1989-90 school year to foster teachers' professional growth. In addition to these activities, the Council provided support for activities sponsored by other agencies, including financing teachers' attendance at regional and national conferences and workshops.

### Reception and Dinner Meetings

#### Opening Reception

The collaborative sponsored a reception for the new school year on December 5, 1989, from 4:30 to 6:30 p.m. All members of the Durham Mathematics Council, including board members and mathematicians from industry and higher education, were invited to attend the event. Sarah Burke Berenson, director of the Center for Research in Mathematics and Science Education at North Carolina State University in Raleigh, was the keynote speaker. Dr. Berenson spoke on "A Model of Change for Implementing the NCTM Standards." Sixty-five people, including 47 collaborative teachers and 9 representatives from the business and university communities, attended the event, which was held at the Sheraton University Center. The event was well-attended.

The participants enjoyed the reception and appreciated the opportunity it provided to network with their colleagues. The project director noted that the teachers were particularly impressed with Dr. Berenson's remarks. One teacher commented, "The speaker was excellent. . . .She presented many thought-provoking ideas concerning mathematics teaching styles and methods for the future. This has inspired me to change or consider changing methods I'm presently using." A second teacher said, "The setting was very nice, the food was excellent and the speaker did an excellent job. She was well prepared and gave us a lot of good information. Vivian's remarks were also useful; we know what to expect for the rest of the year." A third teacher added, "Dr. Berenson's talk was inspirational, she provided us with a great deal of useful information. I wish the date had not been so close to the holidays. It is always a pleasure to talk and compare notes with colleagues." A fourth teacher remarked, "Dr. Berenson was thoroughly enjoyable, informative and motivating. We should consider bringing her back for a small workshop where we can ask questions and have discussions as to how to implement the *Standards*." Another teacher commented, "I'm sorry for such a low turnout and think that the timing (Christmas) wasn't good. The atmosphere was great, food was great and people were great."

The director of the Durham Public Education Fund said in summing up, "It is good to see just what DMC does and to see teachers so eager to talk with each other about mathematics and teaching."

## Dinner Meeting

On April 24, 1990, the collaborative sponsored a dinner meeting to familiarize teachers with the draft of the NCTM *Professional Standards for Teaching Mathematics* and to provide teachers with an opportunity to critique them. The document, drafted by the National Council of Teachers of Mathematics during the summer of 1989, presents standards for teaching similar in tone to the NCTM *Curriculum and Evaluation Standards for School Mathematics*. Following dinner, which was held in the small dining room of the NCSSM, Dorothy Doyle, director of the Mathematics and Science Education Center which is housed at NCSSM and interim project director of the DMC and chair of its Advisory Board, led a discussion on the *Standards for Teaching Mathematics*, providing insights from a conference in Charlotte, North Carolina, which she had attended. During the discussion, the teachers were able to react to the working draft of the document. After the meeting, Ms. Doyle sent a summary of the discussion to Dr. Glenda Lappan, Chair of the NCTM Commission on Teaching Standards for School Mathematics.

Although all collaborative members were invited and an attendance of 25-30 teachers was anticipated, only 14 people, including 9 collaborative and 2 non-collaborative teachers, attended. Those who did attend, however, seemed to greatly appreciate the opportunity to have input into the development of the *Standards for Teaching Mathematics*. One teacher remarked, "This was a good discussion. We felt that we could send back ideas for change. . . .We do not want anyone to issue a prescription for teaching and we do want another, fairer method of evaluation, perhaps based on the results that we achieve." A second teacher noted, "It was great to have an opportunity to offer ideas to the Standards Committee. We need more examples of teacher use of the *Standards*. Some of the examples are rather unrealistic and few of them are complete enough for use. It was obvious that those who compiled the *Standards* did not have a wide background in public schools." A third teacher said, "A most worthwhile evening. We saw a draft of the *Standards* for the first time. We had an opportunity to send notes to the committee and felt that we were in on ground level. . . .Dot did a good job of getting everyone involved in the discussion so that all contributed ideas. We felt that actual classroom teachers should be involved in writing the *Standards* rather than college professors who are long removed from the sort of student and classroom that we face each day." A fourth teacher commented, "This was a good chance to express our feelings about not only the *Standards*, but other problems as well. There was lots of communication . . . We now have an idea about what is being done and what the new ideas will expect of us. There was a strong feeling on the part of others as well as me that math teachers should be evaluated by other math people, not on the basis of following a six-or-more step process, but on how the subject is taught." A fifth teacher added, "The worthwhile evening evolved into a good gripe session. At this time of year we needed such an opportunity. The discussion of the *Standards* was thorough and critical in the best sense. I do hope that our ideas for clarification are better and more examples will get back to the committee and that they will act on them. It seems that so many folks want us to do so many things that if efforts are not coordinated, teachers will be so overwhelmed that they will say 'to heck with it all.'" The Mathematics/Science Supervisor for the Durham County Schools said, "I was very disappointed that this meeting was not well attended. Those there were exposed to needed things; overall, it was a good meeting. . . .The teachers had an opportunity to vent their feelings about certain aspects of these *Standards* and to have some feedback. I feel that that alone made the evening worthwhile."

## Workshops and Seminars

### "Show and Share" Mini-Conference

On January 27, 1990, the collaborative sponsored its first "Show and Share" mini-conference. The activity, which was based on an idea that came out of the May 1989 Steering Committee retreat, was held to provide an opportunity for teachers who had received grants to fund their attendance at conferences and workshops, and to share what they had learned with their colleagues.

The half-day program, which was held at NCSSM, began at 9:30 a.m. with registration and a complimentary continental breakfast. During Session I, which ran from 10:00 to 10:45 a.m., six concurrent workshops were offered: "Graphics Calculator Software," "TI Math Explorer Calculator Demonstration," "Data Analysis Using Graphic Calculators," "Hands-On Geometry," "Statistics in the Math Curriculum," and "Topics for Middle School Geometry." During Session 2, which ran from 11:10 to 11:45 a.m., the latter three workshops from Session I were repeated, and a fourth workshop, "Highlights from Exeter and NECC," was added. A total of 35 people, including 18 County and 13 City teachers, participated.

The event was extremely successful. The collaborative's executive director reported that teachers left the workshop excited and ready to get back into the classroom to put into practice ideas they had encountered. One teacher commented, "A great conference. I really enjoyed the workshops I attended. . . .I wish I could have attended some of the other workshops. We need to repeat this sort of conference once or twice each year." A second teacher added, "This workshop was a great idea. I wish it had not been on Saturday. Perhaps we can have one in the middle of a week that will last all day." Another teacher remarked, "This was a very worthwhile activity. The 'Statistics in the Math Curriculum' was of great interest to me. I plan to use many of the things I learned there. It is good to go to a workshop that has something to offer to the basic mathematics teacher that can be used and be of great interest to students." One teacher said, "Most worthwhile. . . .The ability we had to choose where we went was a real plus and made the day enjoyable. Signing up in advance was a good idea. The 'Data Analysis Using Graphic Calculators' was a great section. It made me want to learn to use a spread sheet in order to take the ideas further." A fifth teacher noted, "I got some great ideas for use in my classroom. I will now check out the TI Math Explorer calculators to use with my students. I discovered many motivational ideas this morning." The on-site observer remarked, "A very good idea. This gave those who were interested an opportunity to see what our people have been learning when they go to workshops, etc. They were most enthusiastic about the day and the presentations."

A second mini-conference was scheduled for May, 19, 1990, but in early May was postponed due to the poor preregistration.

## Writing In Mathematics Workshops and Reception

On Friday, March 16, 1990, the collaborative sponsored the workshop, "Writing in the Mathematics Curriculum," conducted by Academics Foundation Professor Dr. Arthur Powell of Rutgers University. The workshop provided participants with an opportunity to examine a variety of writing activities that serve as vehicles for students to learn and communicate mathematics. Dr. Powell presented the same workshop in two sessions, one from 8 to 11 a.m. and one from 1 to 4 p.m. The workshop was offered twice in order to allow one substitute to cover two teachers' classes. Each session had been designed for 25 participants, although only 44 people in all participated. Among the participants were 33 collaborative teachers, 5 non-collaborative teachers, and a representative from business.

The on-site observer reported that the workshop was "very well done" and "well received by all." Teachers' reactions were very favorable. One teacher commented, "This was a timely topic well presented. I want to try the writing with my classes. I am excited about the possibilities. We were involved with the discussion, good examples were given along with illustrations. I wish this had been a full day instead of just three hours. I am not sure how it will affect my teaching, but I think it will have a positive effect. I have been concerned about how I could implement writing in mathematics and now I have a good idea about how to begin." A second teacher remarked, "This was an informative and eye-opening session. . . .I plan to use writing more in my classes. It will give me a closer picture of what students are thinking, whether the message is clear, whether students are learning, and what I can do differently next time." A third teacher said, "Writing Across the Curriculum is an ongoing staff development [topic] at my school. This workshop has given me some additional ideas on the topic to share with other teachers on my team. It has given me some specific ideas [of ways] to use writing to help students learn mathematics. I can see lots of benefits to the students and to me in seeing what students are feeling/connecting/learning. I like Arthur's idea that writing provides a window into the student's thinking." A fourth teacher added, "Very worthwhile, clearly presented, practical examples were given and thorough reasoning led to conclusions. We had opportunities to try the different types of writing and to ask questions. I am not sure that this will work with 6th-graders. I would like to begin incorporating more writing in math. I will have to experiment. I like the idea of multiple-entry logs because it is more specific. I hope that it will help students truly understand math rather than spitting back answers. It will help me to see their understanding and comfort level."

Reception. On Thursday, March 15, the evening preceding the workshop, the collaborative hosted a reception at the Sheraton University Center from 6:30 to 8:30 p.m. to welcome Dr. Powell. Twenty-one people attended the reception and heard Dr. Powell's inspirational talk, "Equity, Writing to Learn Mathematics." Everyone seemed to be impressed with Dr. Powell's message. A member of the DMC Board of Directors who is affiliated with IBM said, "Dr. Powell's remarks are on the mark, not only for the teaching of mathematics, but the approach proposed is the basis of a successful person in any business. If mathematics as a way of thinking is used in the schools, business will be run better." A representative of the North Carolina Division of Youth Services commented, "An excellent, provocative presentation which presented the notion that math as a way of thinking offers more for the overall development of students than math as a body of knowledge. The workshop would help teachers rise to the challenge of working with unprepared and unmotivated students." Claire Saint-Rossy, program associate of the University of North Carolina's and NCSSM's Summer Ventures in Science and Mathematics summer program for academically talented students, commented, "Arthur Powell did his audience the great service of putting the ideas offered for their consideration into practice in his own delivery. This presentation of the merits of approaching mathematics as a way of thinking by encouraging students' reflection on their own and their classmates' mathematical activity was truly engaging."

## IBM Seminar

IBM offered a day-long information-sharing seminar for collaborative teachers on May 11, 1990, from 8 a.m. to 3:30 p.m. The purpose of the activity, which was held at the IBM office in Raleigh, North Carolina, was to introduce teachers to new mathematics education software and to provide them with an opportunity to use it. The nine software packages presented were: 1) the *Mathematics Exploration Toolkit*; 2) *Algebra Series*; 3) *Geometry*; 4) *Money, Measurement, and Time*; 5) *Math Concepts Series*; 6) *Math Practice Series*; 7) *The Integration of Mathematics into the Reading for Information Series*; 8) *Personal Science Laboratory*; and 9) *PSI NET*. All collaborative teachers were invited to the seminar, but attendance was limited to the first 25 to apply. The collaborative publicized the event and coordinated registration.

Twenty collaborative teachers, 10 City and 10 County teachers representing eight schools, participated in the seminar along with the executive director of the collaborative and a representative from higher education. Three teachers who had registered, bringing the total to 25, did not appear for the seminar. The on-site observer reported that the teachers who attended "were quite pleased with the activity." One teacher commented, "This was a very worthwhile session; everything was of interest and relevant, and there was a volume of information. We could have used more time for depth of discussion and the different aspects of the programs and hardware. More space and more computers would have been helpful. I will make a concentrated attempt to obtain means to purchase and then use the information in my classes. Teaching must now be more concept-oriented, computer assisted and inductive to produce and encourage thinking." A second teacher said, "The opportunity to experiment with the software was a definite strength and the hands-on experience was invaluable. The presentation made me more aware of the many areas of mathematics education which could be introduced using computers. I see many areas in which I could have used software to assist student understanding of mathematical concepts. The leaders were quite helpful and allowed us to experiment with the materials." A third teacher remarked, "The activity was very worthwhile. The hands-on activities were interesting. I will use this information in introducing lessons, tutorials, and hands-on activities for the students. I will definitely use more computer lessons in my classroom; I will make more use of the computer lab in my school." A fourth teacher noted, "The variety of presentations combined with hands-on activities made the time fly. . . .I will try to persuade my school to purchase at least one IBM computer and some of the software used for our use in classrooms. I was frustrated because we do not have the equipment, but [it] also encouraged me to use my students as resources." A fifth teacher added, "The activities were fun and informative. I do not have access to computers for my classes so the information will not benefit me at the present time but will be filed away for the future as we are lobbying for computers at my school." In an article about the seminar that appeared in the June issue of the DMC Newsletter, a teacher wrote, "One nice feature was that we were guided through the software by Curt Wall, a teacher on leave working with IBM. Everyone enjoyed the fun-packed workshop. The highlight was leaving with our own 'goodies' of the day: a notebook filled with useful information, posters for the classroom, and our new understanding of IBM software."

## Subject Area Networks

The collaborative's teacher-generated subject-area networks are an important support vehicle that emerged as an outgrowth of DMC activities. The networks provide teachers with opportunities to meet in small groups to discuss issues and to share information on specific subjects that are of interest to the participants. The Algebra II/Pre-Calculus Network was established in spring, 1986; the Geometry Network during the 1986-87 school year; the Middle School Network in Spring 1987; and the Calculus and the Basic Networks were established during the 1988-89 school year. A policy was instituted during the 1988-89 school year to offer one continuing education credit to teachers who participated in the Algebra II/Pre-Calculus, Geometry, or Middle School Networks. To participate for credit, teachers were required to attend all of the network meetings in their subject area, adopt new ideas in their classes, and meet at the end of the year to evaluate the program. However, none of the teachers attended all of the Network meetings and, therefore, no one qualified for CEU's. This program continued during the 1989-90 school year.

Following a joint meeting of all the networks, held in November, 1989, the executive director decided that rather than continuing to schedule meetings for each network for the 1989-90 school year, regular meetings of only the two most popular, the Algebra II/Pre-Calculus Network and the Geometry Network, would be held and that meetings of the other networks would be scheduled only if the interest or need arose. A separate chairperson was appointed for each of the two networks.

Joint meetings of the two networks were held in February and March, 1990, and the two network groups each met independently in both January and April. All but one of the network meetings were held at NCSSM. The meetings were publicized through the DMC Newsletter and some were announced through special mailings of one-page fliers that were sent to all mathematics teachers. Teachers who attended the meetings thought that they were very worthwhile. Overall, however, attendance was very poor, ranging from four teachers for the independent network meetings to eight teachers for the joint meetings of the two networks.

## General Meeting of All Networks

The DMC hosted a general meeting of all the networks on November 29, 1989, from 4 to 5:15 p.m. at the North Carolina School of Science and Mathematics. The activity was designed to bring participating teachers together for the first time during the 1989-90 school year and to provide an opportunity for discussing end-of-year testing. Dr. Cleo Meeks and Robert Evans, North Carolina Department of Public Instruction, led the discussion, sharing the end-of-year testing results that had recently been released, as well as the results from past years. Nineteen collaborative teachers, two school administrators, and the collaborative director and on-site observer attended for a total attendance of 23.

The teachers seemed to appreciate the opportunity to get their questions answered regarding end-of-year testing, although not all of the teachers were convinced of the benefits of the testing. One teacher remarked, "It was very interesting to hear Cleo Meek's version of why we have end-of-course testing, though I do not agree with him. I wish that we had a room more conducive to group discussion and I wish that we had more time to express opinions about the topic. It took too long to get down to business. When we come at the end of a school day we expect bare bones, not fun and games." A second teacher commented, "Cleo and Bob were well prepared and able to answer our questions. It was a good idea to have this session so that we could be more informed. I will try to explain the rationale behind the testing to other teachers from my school. We are going to have to teach to the test for at least two more years." A third teacher noted, "We need to start our business on time so that we can leave by 5:00 p.m. My questions about test development were answered and I plan to volunteer to write test questions if I ever have an opportunity to do so. The event was worthwhile." A fourth teacher said, "This was pretty much a repeat of what Bob Jones told us last year. Cleo and Bob Evans were, however, more in favor of the testing as it is now than was Bob [Jones]. I learned that if I want to look good, I am going to have to go along with the present testing for at least the next two to three years." A fifth teacher said, "It was worthwhile to find out that the state department is still insisting that the testing is fair even when their own figures show a lack of concern with equity. I plan to write letters in an attempt to change things." Dr. Meeks commented, "It is good to speak with teachers. This organization gives us an opportunity to do just that. We can, if we all work together, improve test scores in North Carolina."

### Algebra II/Pre-Calculus Network

The Algebra II/Pre-Calculus Network, the first network to be formed, is designed to bring together City and County teachers of Algebra II, Algebra III, Pre-Calculus and Calculus to share ideas and to help one another with problems. The network held two independent meetings during the 1989-90 school year: January 11 and April 10, 1990. A final meeting of the network was scheduled for May 10, but no one showed up.

At the January meeting, which was held from 4 to 5 p.m., Vivian Leeper-Ford discussed the use of the *IBM Toolkit* in pre-calculus classes. The four teachers in attendance seemed to find the meeting worthwhile, although they expressed disappointment that more teachers were not present. One teacher said, "Good program. Vivian did not talk too much and we had ample time and opportunity to evaluate the software for ourselves." Another teacher noted, "Very worthwhile. I would not change anything except the attendance which was very poor. I will use the *Toolkit* and look forward to checking it out." The third teacher commented, "I enjoyed the presentation. Wish more could have been here. It was particularly good to be able to use the material. I will use the *Toolkit* in my classes as a demonstration device." The fourth teacher added, "I was glad to experiment with the *Toolkit*. I have many questions about its use. I may use it, but I will be very sure that the students know what is happening. It could become a button-pushing exercise instead of a true learning device."

The April 10 meeting of the Algebra II/Pre-Calculus Network focused on the NCTM *Curriculum and Evaluation Standards for School Mathematics* and what affect they will have on teachers. The six collaborative teachers who attended the meeting had an opportunity to express opinions and share ideas as to how they might implement the *Standards* under the current restrictions mandated by the State of North Carolina. All the teachers enjoyed the discussion, which was led by collaborative teacher Kathy Lynch. One teacher said, "The activity was worthwhile. The strengths were in the free exchange of ideas and information. I wish that more teachers could have been there. I will take the conclusions of the discussion back to my school and try to persuade the other teachers there that there is much merit in them. My teaching will probably not be impacted to any great degree, but I do have a feeling that I am correct in what I am now doing." A second teacher commented, "This was a delightful session. I was pleased in that we discussed rather than listened. It is so good to be with others who face the same problems that I face in the classroom. The ideas we got for implementing the *Standards* are good and I intend to use them in my classroom. I was pleased to have many things that I did not fully understand explained in detail by the other teachers." A third teacher remarked, "This was a very worthwhile session. We got to get many things off our chests. A good gripe session is very good for morale. I feel that we found ways to get around restrictions and still teach our students to think."

## Geometry Network

The Geometry Network, formed during the 1986-87 school year, was established to address issues and techniques related to the teaching of geometry. The network met independently two times during the 1989-90 school year on the same dates as the Algebra II/Pre-Calculus Network: January 11 and April 10, 1990. No one showed up at the final meeting of the network, scheduled for May 10.

The January meeting featured a workshop on hands-on geometry activities that are fun, conducted by collaborative teacher, Verdrey Madzimoyo. During the meeting, which was held from 4 to 5 p.m., Ms. Madzimoyo distributed a variety of materials to the four teachers who were present. The teachers seemed to greatly enjoy the session. One teacher commented, ". . . It certainly was fun. My students will really enjoy these things when I use them as I plan to do. Verdrey did a fine job of introducing us to the material and then letting us play with it." A second teacher remarked, "Very worthwhile. I enjoyed it very much. The strength was in the hands-on presentation rather than a lecture. I would not have changed anything and [I] plan to use the ideas in my classroom." A third teacher added, "Very worthwhile. The patterns we were given will be most useful in making hands-on materials. I wish more teachers could have been there." The fourth teacher said, "Good workshop. We did not have enough time to try everything. Maybe we should repeat this when more can attend."

Verdrey Madzimoyo also led the discussion at the April meeting of the Geometry Network. At the meeting, which was held at Northern High School from 3:30 to 5 p.m., Ms. Madzimoyo demonstrated geometry software. Attendance was much less than anticipated, with only five collaborative teachers, including the collaborative executive director, attending the meeting. The participants felt that the session was worthwhile. One teacher remarked, "The major strength of the meeting was that I was able to use the software and experiment with that which I do not have. I will try to purchase software for my own classroom use. The activity helped me to learn how to implement this material in my classroom." A second teacher commented, "The activity was worthwhile; it was great to see the variety of computer software that is available for use in geometry. I now know what is available if I choose to use it and I may do just that." A third teacher said, "I enjoyed using the various software packages. I will use this material in my classes only if I have more chances to practice and use it myself." A fourth teacher noted, "Even though I already knew about most of the packages, it gave me a chance to do uninterrupted experimentation. I may use the *[Geometric] Supposer* in my classroom next year; it is too late to use it this year."

## Joint Meetings of the Algebra II/Pre-Calculus and Geometry Networks

February 8, 1990. Two joint meetings of the two networks were held during the 1989-90 school year: February 8 and March 8, 1990. The February meeting featured a presentation, "The Modern Napoleon," by Annie John Williams, a retired Durham City Schools mathematics teacher. Ms. Williams, with the assistance of NCSSM art teacher Joe Liles, presented a paper and computer simulation on Napoleon geometry. Handouts containing information on the background of Napoleon geometry, examples, and a bibliography were distributed to the participants, who included seven collaborative high school teachers, one collaborative middle school teacher, and the executive director of the collaborative, the secretary, and the on-site observer. Although some of the teachers felt that the session lasted a little too long, everyone seemed to feel that they learned quite a bit from the session. One teacher said, "I really enjoyed the presentation. Annie John and Joe had obviously worked very hard on it. Her enthusiasm is contagious. I wish more had been able to attend. This gives me an interesting idea to introduce to my geometry students." A second teacher added, "The meeting was worthwhile . . . . It would have been better if we had been allowed to be more involved with the software. The handout promises to be very useful and it certainly is well done." Another teacher commented, "The session was worthwhile. It was a bit too long and we had little opportunity for interaction. I would have liked to try the computer myself. This would make a very good math fair project for a student who might be considering a geometry project. I will tell my students about it but doubt that I will use it in my classes." A fourth teacher contributed, "I had never heard of the Napoleon triangle nor did I have any idea that he was a geometrician. It was a most worthwhile session. Our school has 'The AutoCAD Tutor' in the mechanical drawing department. I plan to try to borrow it in order to show my students what it can do."

March 8, 1990. At the March joint meeting of the two networks, on-site observer Betty Peck led a discussion on problem solving. Eight collaborative teachers and the collaborative executive director attended. The low attendance was attributed to poor publicity, with the only announcement of the meeting being a listing in the February newsletter. The collaborative administration realized that the publicity for the networks will have to be improved for future meetings. The teachers who did attend the session had very favorable reactions to it. One teacher remarked, "The emphasis on solving problems with diagrams and drawings impressed me very much. It will change my approach to teaching these problems. It would have been good to have more of these examples. I will use the problems we were given with my students." A second teacher said, "The session was very worthwhile. It enforced my belief that there are no problems that are unimportant. I will mix different sorts of problems in my teaching and in my assignments rather than deal with only one kind at a time. I have more empathy with my students and their anxieties after taking the analytic skills test." A third teacher commented, "I especially enjoyed the analytic skills test. The problem list will be valuable. I will use both with my classes. I wish we had more time on actual problem solving. After wading through some of these, I will have more patience and understanding of my students' difficulty with problems." A fourth teacher noted, "Yes, the meeting was worthwhile. The fact that it was a discussion rather than a lecture appealed to me. We need to have input in order to really get something out of these sessions. The materials that were given us will be very useful and I look forward to presenting them to my classes. The diagram approach to problem solving is new to me and I plan to use it." A fifth teacher remarked, "We need to do a better job of announcing these meetings and their topics. I am sure that more teachers from my school would have been here if they had been reminded and told of the topic to be discussed. We all need help with problem-solving techniques in order to do a better job of teaching this vitally important skill to our students. This session was a good start to giving us that help."

## Grants

The Durham Mathematics Council offered funding to secondary and middle school mathematics teachers in Durham City Schools and Durham County Schools through its Travel Grants, University Study and Independent Work Grants, and Mini-Grants programs. According to the guidelines for Requests for Funds, which were revised February 15, 1990, teachers seeking financial support are to submit a proposal plan of professional development to the DMC Advisory Board, a sub-committee of the DMC Board of Directors. The professional development plan, which is to be developed with advice from the executive director, cites both specific activities envisioned by the participant for the next twelve months and general professional objectives for the next four years.

Additional funding was available to Durham teachers through the NCCTM Mini-Grant program and the Durham Public Education Fund Teacher Initiative Grants. The Durham Mathematics Council provided clerical support to collaborative teachers to assist them in applying for collaborative grants as well as for those awarded by other agencies.

## Travel Grants

The Durham Mathematics Council awarded funds to teachers to attend state and national meetings, to participate in workshops, and to visit schools with model programs. The travel grants were designed to provide teachers with the opportunity to be involved in the formulation and discussion of national issues in mathematics and mathematics education. By visiting other sites, teachers will be exposed to new ideas and methods that can be used in their own schools. In allocating the travel funds, the Advisory Board assigned highest priority to those programs that would enable teachers to bring back information to share with other teachers. In addition to transportation costs and registration fees, funds also were available to pay substitute teachers. Following a trip, participants were expected to submit written reports of their experiences and to give a presentation at one of the monthly teacher meetings, although this policy was not always enforced.

During the 1989-90 school year, the DMC Advisory Board awarded travel grants to enable teachers to attend a variety of state, regional, and national conferences and institutes; they included a $370 grant awarded to collaborative teacher and Executive director Vivian Leeper-Ford to attend the workshop, "Making Mathematics Work for Minorities," in Atlanta on October 5-6, 1989. The workshop was sponsored by the Mathematics Department of Spelman College, Atlanta. DMC grant awards also included $47 awarded to each of 12 teachers to attend the State Conference of NCCTM in Raleigh, October 12-13, 1989; and a travel grant totaling $258.80 to two Durham City teachers to attend the North Carolina Educational Technology Conference in Greensboro, December 4-5. Travel grants totaling $258.50 also were awarded to two collaborative teachers to attend the NCCTM Central Region Conference in Greensboro on March 1, 1990. The collaborative had been prepared to award ten grants, but only two teachers submitted applications by the deadline. The two teachers participated as workshop leaders. Further grants were awarded as follows: grants totaling approximately $3,360 to five teachers (including one to the collaborative's executive director) to attend the 68th Annual NCTM Conference in Salt Lake City, Utah, April 17-21, 1990; a grant of $308 to a city collaborative teacher to attend a regional mathematics symposium sponsored by the Southeastern Educational Improvement Laboratory May 5-6, 1990; a grant of $195 to one Durham City teacher to attend the Advanced Placement Workshop in Durham, June 15-16, 1990; a grant of approximately $850 for a Durham City Schools teacher to attend the

National Educational Computing Conference (NECC) in Nashville, Tennessee, June 15-16, 1990; grants of $850 each to three DMC teachers to attend the Phillips Exeter Academy in Exeter, New Hampshire, June 24-29, 1990; grants in the amount of $432 each for two Durham County teachers to attend an Advanced Placement Institute at Wake Forest University in Winston-Salem, North Carolina, June 25-30, 1990; and a county high school teacher received $125 to attend the Woodrow Wilson National Fellowship Foundation Geometry Institute at NCSSM in the summer of 1990.

## University Study and Independent Work Grants

These DMC grants are designed to support two key activities of its members: 1) university study in mathematics and 2) teachers' independent work in mathematics during the summer.

The Durham Mathematics Council will provide a stipend to help pay for tuition, fees, and books to a teacher who enrolls and successfully completes a mathematics-related university course. During the 1989-90 school year, DMC awarded a $500 grant to a Durham County Schools teacher to take a graduate course at the University of North Carolina-Chapel Hill during the summer of 1990.

Grants were also available to provide teachers with up to one month's salary during the summer to pursue an area related to the goals of the collaborative, such as curriculum or materials development. These grants are awarded on a competitive basis, with special consideration given to projects aimed at groups that are traditionally underrepresented. Several teachers received these independent work grants for the summer of 1990. The DMC provided funds totaling $1,260 to a Durham County teacher to work for two weeks planning and preparing lessons and models to enhance critical thinking skills. The collaborative also awarded $1,550 to a Durham County Schools teacher to work for two weeks during the summer of 1990 gathering supplementary materials to enhance curriculum using the TI Math Explorer Calculator. Two County teachers were awarded a summer grant totaling $4,298 to work together on a resource manual for geometry that would include supplementary problems, worksheets, tests, puzzles, motivational games, and suggestions for the reorganization of selected chapters and for teaching proofs.

## Outcomes of Study and Work Grants Awarded for Summer 1989

Wallis Green of Jordan High School had received a grant to work during the summer of 1989 to develop materials for a Discrete Mathematics Course. In addition, she received money to purchase blank tapes for duplicating "For All Practical Purposes" videos. As one outcome of her grant, Green prepared a reference paper on teaching a Discrete Mathematics Course which included extensive bibliographic notation. Ms. Green wrote, "I hope that the information in this paper will be a start for anyone who is going to teach a discrete math course or a course like the one I am teaching. I have not included data analysis or combinatorics in this paper because in my school system they have listed the first semester as Discrete Math and the second semester as Probability and Statistics. I am going to take some liberty with the course material, but I plan on using data analysis and combinatorics in the second semester along with trig modeling, mathematics of finance, and the use of the graphing calculators for working with both functions and statistics. I do not have any advice for a text book yet, but I am continuing to look. I would be interested in getting together with others who are interested in the topics that I have covered in this paper."

The information and material gathered by Ms. Green was instrumental to the development of a project in the Durham County Schools that focused on the development of a course in discrete mathematics. Steven Unruhe, a County teacher who has been very active in the collaborative, worked on this project. He reported that the proposed course will be organized around four topic areas "which coincide very closely with Wally's curriculum." The course is to be offered during the 1990-91 school year.

Verdrey Madzimoyo, a Durham County Schools teacher, received funding to purchase manipulatives and to work during the summer of 1989 to develop lesson plans which use the materials to enhance the geometry curriculum. Ms. Madzimoyo's grant work served as the basis of two workshops that she led for the Geometry Network during the 1989-90 school year. As an outcome, Ms. Madzimoyo prepared lesson plans that were available to other teachers through the Resource Center.

## Mini-Grants

The DMC's Mini-Grant Program supports innovative efforts to enrich and strengthen the mathematics curriculum in the Durham City and County Schools. These grants are designed to encourage teachers to pursue innovative classroom approaches by providing seed money for instructional experimentation and equipment, for the development of new curriculum and materials, and for nontraditional mathematics courses. A teacher can apply for a mini-grant of up to $300 for classroom improvement. The mini-grants can be used to purchase materials, hire consultants, or visit other programs. Mini-grants provide teachers with the resources to pursue new approaches and activities that would otherwise be unexplored.

Grant applications are reviewed and approved by the DMC Advisory Committee. In order to encourage teachers to work together, special consideration is given to projects that involve more than one teacher and more than one classroom.

Approximately five requests for mini-grants were received during the 1989-90 school year, all of which were awarded. Among the mini-grants awarded were: grants in the amount of $300 each for two Durham County teachers to jointly purchase an LCD (Liquid Crystal Display Projection System) for use in their classrooms; a grant of $225 for a Durham City teacher to purchase a lab pack of *Green Globs* software for use in her classroom; a grant of $253.75 for a Durham City teacher to purchase a lab pack of "Graphics Calculators" by Conduit for use in her classroom; a grant of $300 for a Durham County teacher to purchase TI-30 SLR calculators for use in her classroom; a grant of $300 for a Durham County teacher to purchase Sharp EL-5200 Calculators. A Durham County teacher received a grant of $104.95 to purchase Algebra-Math videos and to fund two substitute days so she could attend a "Math Counts" workshop in Raleigh, on October 25 and December 11, 1989, sponsored by the North Carolina Department of Public Instruction; a county teacher received a grant of $272.85 to purchase the Middle Grade Mathematics Project Series and Kit to share with the other 8th-grade teachers. These materials are targeted for curriculum reform on a daily basis in general mathematics and pre-algebra. A county teacher received a grant of $300 to purchase TI 30 SLR Plus calculators for problem solving in practical applications. He plans to share his experience of incorporating the calculator work into lesson plans with other teachers; six teachers from a County high school received $1,800 to purchase ten memory expansion cards for their existing equipment; and two teachers from this same high school received a grant totaling $600 to purchase resource books and manipulatives for their classrooms.

## Outcomes of Mini-Grants Awarded During 1988-89

Two County School teachers, Rita MacMillan and Tracy Harting, had received a mini-grant to work together during summer 1989 to develop a resource manual for geometry that would include supplementary problems, puzzles, motivational games, worksheets, tests, and suggestions for reorganizing some chapters and for teaching proofs. The manual is now available in the DMC Resource Center.

A mini-grant was awarded to a County teacher, Linda Batchelor Daniels, to prepare materials and overhead projector sheets for the S.A.T. Improvement Project. As a result of the grant, all the teachers at her high school now have access to the materials from the S.A.T. Improvement Project notebook to use on a daily basis. The materials are used extensively in Algebra I classes as warm-up exercises, as review for contests, and for the State Examination in Geometry classes. Ms. Daniels wrote, "We have used the S.A.T. Improvement Project notebooks a great deal, and I believe that having the information readily available to the teachers will cause it to be used even more. . . ."

## NCCTM Mini-Grant Program

During the 1989-90 school year, the North Carolina Council of Teachers of Mathematics (NCCTM) instituted a mini-grant program designed to promote excellence in mathematics education. The program, available only to NCCTM members, was developed to provide funds in each of the three NCCTM regions for special projects and research that will enhance the teaching, learning, and enjoyment of mathematics. An allocation of $1,000 was made to each region.

## DMC Resource Center

The Teacher Resource Center was established in the spring of 1987, in office space provided by NCSSM. The Center, which is open between 7:30 a.m. and 5 p.m. weekdays, serves as an off-site workplace for teachers, and also provides teachers access to computers, software, videotapes, calculators, manipulatives, and texts and supplemental materials.

The Center provides classroom sets of TI Math Explorer Calculators and Sharp EL-5200 graphing calculators that teachers are encouraged to check out. In March, 1989, IBM donated an IBM System 2 computer to the Center and the DMC added an overhead projection monitor to the system (which includes a hard disk, printer, and internal modem). During the 1989-90 school year, the Center began to loan the system to schools for a six-week period so that teachers could use it in their classrooms over an extended period of time.

An inventory of all the materials in the Resource Center was started in the summer of 1989 and was completed in the fall. A copy of the resource list was distributed to each school through the members of the Steering Committee. Information about resources available, as well as new materials acquired by the Resource Center, is published in the DMC Newsletter. Teachers are continually encouraged to use the Center's resources. A study of teacher usage of the Center is being planned.

## Collaborative Newsletter

The Durham Mathematics Council's Newsletter was published seven times during the 1989-90 school year, in July, November, December, 1989; February, March, April, and June, 1990. Copies of the newsletter were sent to Steering Committee members for distribution to their building teachers in the City and County School systems, as well as to mathematics users involved in DMC activities, and to donors, Board members, school principals, and district superintendents. The newsletter, which averages seven pages, is a primary tool for disseminating information. It highlights upcoming activities, provides articles on topics in mathematics and mathematics reform, highlights materials available at the Resource Center as well as listing new acquisitions, and offers reports from DMC members (including notes on teachers who attended conferences) and from the Council's executive director.

## State, Regional, and National Conferences and Seminars

### Woodrow Wilson Summer Institute on Geometry and Follow-Up Workshop

DMC sponsored the attendance of ten collaborative teachers at a Woodrow Wilson National Fellowship Foundation Summer Institute on Geometry at NCSSM July 24-July 28, 1989. The Institute, which focused on introducing geometric concepts to students, was presented by four Master Teachers who had received training at Princeton University under the direction of the Woodrow Wilson Foundation.

Institute enrollment was open to all geometry teachers in North Carolina, on a first-come, first-serve basis. A total of 29 teachers participated in the Institute. The ten collaborative teachers who participated received 3 CEU credits and a $35-per-day stipend funded by a Title II grant that partially supported the Institute.

The Institute was extremely successful. One teacher remarked, "I thoroughly enjoyed all aspects of the workshop. The manipulatives and models gave me something I could use immediately in my classes to allow students to do more discovery activities. The activities that the instructors led were very interesting . . . . I wish there was more time to develop all of the ideas so that I could fit [them] into the curriculum. This workshop also allowed me the time to think about what the most important concepts in geometry are." A second teacher commented, "This was one of the best workshops I have attended. I have picked up more activities and ideas to take back immediately into my classroom to make me more effective. The sharing of ideas with other geometry teachers was the best point. The instructors were excellent and very informative." A third teacher added, "Excellent! This workshop provided me with many ideas and materials with which to improve my courses and methods of instruction. It was offered at the right part of the summer in order to gear me back to thinking about going back to work." A fourth teacher said, "There was a lot of energy in this workshop both from presenters and participants. Innovative teaching was well-modeled and I am leaving with many practical and useable ideas. Very valuable knowledge has been gained which will be very helpful in the special computer work I am doing in geometry." A fifth teacher remarked, "This is one of the best workshops I've ever attended. I am glad someone else canceled so that I could attend. I especially enjoyed opportunities to talk with other teachers and to make models to implement in my classes. I very strongly recommend that other teachers attend."

On Saturday, February 24, the teachers who participated in the Geometry Institute met at NCSSM. The session, which ran from 9:30 a.m. to 12:30 p.m., was led by Barbara Rockov, one of the Institute's leaders. The purpose of this follow-up session was to give the summer participants the opportunity to share ways they implemented new ideas in their classrooms.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC sponsored attendance at the workshop for two teachers from each collaborative, paying for room, board, registration, and transportation. The two teachers who represented the DMC were selected by the collaborative's executive director.

## NCCTM State Conference

Twelve County collaborative teachers each received a DMC Travel Grant award of $47 to attend the State Conference of the North Carolina Council of Teachers of Mathematics (NCCTM). The conference was held in Raleigh, October 12-13, 1989.

## NCCTM Regional Conference

Two collaborative teachers received DMC Travel Grants to attend the 18th Annual NCCTM Central Region Mathematics Conference held in Greensboro on March 1, 1990. There were thirty sessions and twelve workshops, affording the attendees a wide variety of offerings. The featured luncheon speaker was Donna Oliver, an associate professor of education at Bennett College in Greensboro. Ms. Oliver was North Carolina's Teacher of the Year for 1986 and the National Teacher of the Year for 1987.

The collaborative had planned to award up to ten grants, but only two teachers had submitted applications by the deadline. Five other collaborative teachers attended the workshop at their own expense. All seven teachers participated as session or workshop leaders.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Five DMC teachers, including Executive Director Vivian Leeper-Ford, received funding to attend the 68th Annual Meeting of NCTM in Salt Lake City, Utah, April 18-21, 1990. The theme of the conference was "Climbing to New Heights in Mathematics." Teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened to seek new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working session on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, whose address was titled, "Students of Color Through Staff Development."

The collaborative awarded Travel Grants totaling $3,360 to the five teachers to cover their travel and hotel expenses, as well as their registration fees. The City and County

School systems also provided substitute teachers. The teachers who attended were selected by the DMC Advisory Board. As part of the grant application, teachers had to indicate how the meeting would benefit them, and in turn, the DMC. Accounts written by two grant winners about their experiences at the conference were published in the June issue of the DMC Newsletter. Both teachers seemed very excited about having had the opportunity to attend the conference and about the sessions they had attended. One teacher wrote, "The 68th Annual Meeting of NCTM was held April 17-20 in beautiful Salt Lake City, Utah. We could see the snowcapped mountains from our hotel windows. I am pleased that the Council provided the funds that allowed me to attend this conference so that I could learn some new strategies to use in my classroom. One session I attended was presented by Alan Foster on the topic 'Algebra for the 1990s: What Should Be Taught and How?' He discussed some excerpts from the NCTM *Standards* on topics and changes in instructional practices that will decrease or increase in importance. He discussed an interesting application problem that deals with slopes, lines, and parabolas that could be worked on by small groups of students. Another interesting session was presented by Henry Pollak on 'The Critical Role of Mathematics in Industry and Its Implication for Mathematics Education.' He was adamant that we teach our students how to be good problem solvers. He stated that we need to teach them how to work with others since people in industry must work cooperatively on projects. . . ." The second teacher's written comments included, "During this [UMC] two-session workshop [Thursday and Friday], we learned about our individual risk-taking behavior, we observed others' managerial styles, and discussed these in terms of affecting change. I enjoyed these sessions tremendously, especially the excellent food, but I left the workshop/luncheon meeting wishing I'd had more opportunity to talk."

## Southeastern Education Improvement Laboratory Symposium

A city collaborative teacher received a $308 travel grant to attend a regional mathematics symposium sponsored by the Southeastern Educational Improvement Laboratory, May 5-6, 1990. The symposium was designed to present strategies for raising the performance and expectation of students and mathematics practitioners. The agenda consisted of four sessions: "Cooperative Learning and Mathematics," presented by Steve Parsons of the Johns Hopkins Cooperative Learning Center; "Successful Secondary

Mathematics Strategies," presented by James Strickland from Georgia Southern College; "Successful Middle School Strategies," presented by Leo Edwards from Fayetteville State University; and "Alternative Evaluation Strategies," presented by Jeane Joyner of the North Carolina Department of Public Instruction.

The teacher seemed to enjoy the conference and was very appreciative of the support she received from the DMC. In an article that appeared in the June DMC Newsletter, she wrote, "All of the presentations were very good. Most of us were particularly impressed with Leo Edwards' presentation. A most valuable portion of our time was spent in working groups to prepare group reports for presentation on Sunday morning. For me, this was an enjoyable learning opportunity. Thanks so much, DMC. I returned to my classroom with a wealth of information and activities which I plan to share at the fall DMC mini-conference."

### Phillips Exeter Conference on Computers and Mathematics

The Durham Mathematics Council sponsored the attendance of three teachers at the Sixth Annual Mathematics and Computer Conference, June 24-29, 1990, at Phillips Exeter Academy in Exeter, New Hampshire. All DMC teachers were encouraged to apply for travel grants, which included travel, registration, and room and board expenses. Participants at the conference explored the mathematics curriculum for today and the future, with special focus on the impact and applications of technology in the classrooms. One teacher commented, "Attending this activity will allow me to pursue my interest in using writing activities in my mathematics classes."

## E. Observations

With respect to both its organizational structure and financial base, the Durham Mathematics Council experienced problems during 1989-90 that culminated in serious questions at the end of the school year. Despite these problems, the teachers who have participated in DMC activities speak very highly of their involvement and the impact that it has had on them professionally and in their mathematics teaching.

## Project Management

The 1989-90 school year tested the resilience of the Durham Mathematics Council's administrative structure. A number of forces exerted pressure on the management of the collaborative during the year. Many of these forces were associated with changes in key personnel or the collaborative's need to seek funding other than that from the Ford Foundation to maintain the project. At the beginning of the school year, the collaborative was faced with obtaining a new executive director. In the spring, the collaborative director left to assume another position. The host agency, NCSSM, had a new director. Both of the school districts had appointed new superintendents within the year. Among all of these changes, the Board of Directors of the Durham Mathematics Council was struggling to maintain the Council's financial stability--trying to establish a link with the Durham Public Education Fund with the hope that an affiliation with that organization would help raise the money needed to meet the funding requirements of the Council. The survival of the Durham Mathematics Council during this year of many transitions testifies to the faith that a number of people who participate in DMC programs and serve on the Board of Directors have in the Council and what it is doing. But during the year there was not as broad a base of teachers participating in Council activities as there had once been. Also the Council's Board of Directors was more involved in decision making than had been the case in previous years.

One factor that exerted pressure on the Council during 1989-90 was the issue concerning its relationship with the North Carolina School of Science and Mathematics. Some changes occurred at the school with the change in director. During the year questions arose as to the nature of the communication between the outgoing NCSSM director and the incoming director regarding the relationship of the school and the Council. During the first part of the school year it appeared that the new director did not place a high priority on the Council. This perception was primarily a result of the fact that there had not been any communication between the new director and those associated with DMC. The NCSSM director attended a DMC Board of Directors meeting for the first time in March. At this meeting some issues were raised by the director and members of the Board about the school's interest in continuing to house the Council office at the school. Subsequent meetings between the chairman of the Board and the NCSSM director followed. Based on these conversations, the NCSSM director affirmed his commitment to having the Council reside at the school until some other viable alternative presented itself.

Hosting the Council represented one of NCSSM's commitments to provide more outreach to North Carolina's mathematics and science educators. The office space and Resource Center for the Council was moved to a cottage adjacent to the main buildings on campus. This provides visitors easier access to Council resources.

A second factor leading toward some disruption in the management of the DMC was the amount of time that the director, Dr. Brown, was able to devote to the collaborative. With the change in NCSSM directors, Dr. Brown was required to spend more time on his research responsibilities as dean of Special Programs and Research. This meant he had less time to devote to Council business or to spend working with those on the Board of Directors in fund raising, or in publicizing the Council. In March, 1990, he resigned his position as dean to assume a position with the North Carolina Community College System. Even though Dr. Brown viewed his role with the collaborative as being that of providing behind-the-scenes support, his inability to devote time to the Council seemed to reduce needed communication between the Council and the NCSSM administration.

A third factor that caused some disruption during the year was the delay in securing an executive director until October, 1989. This delay was caused in part by the time required to work out the details with the Durham City Schools for obtaining the services of a mathematics teacher, to be released on a part-time basis. The absence of an executive director at the beginning of the school year, along with all of the other issues, was a factor in some of the activities not being held during the year. Some teachers who had been active in the Council in previous years were unsure of what the Council would be doing during the year and made commitments to other time-consuming activities such as serving as class advisor, talent show advisor, or prom advisor. The Math Fair, targeted by the Steering Committee for May, 1989, as something DMC should oversee, was delayed because of insufficient time to plan adequately for the event. In addition, the actual time spent on the Council by the executive director was reduced from previous years. For example, the executive director did not give the high priority to personal contacts that the previous executive director who visited each of the City and County schools had given. Thus teachers from one school, where all of the mathematics teachers changed and there was no representative on the Steering Committee, had little personal contact with the collaborative and did not participate in Council activities. Part of the problem with visiting schools was that the executive director, a practicing teacher, worked for DMC primarily in the afternoons, which was less convenient for reaching teachers at their schools.

A major priority of the Board of Directors during the year was to establish a relationship between the collaborative and the Durham Public Education Fund. This required time on the part of the members of the Board of Directors if they were to help the Fund with its fund raising. The prospect of transition caused some instability that was aggravated by a perceived shortfall in the budget, a reduction in financial commitment by the Durham Public Education Fund, and a question as to whether the districts would be able to continue their financial support of the Council. Because of the financial questions facing the Council, the chair of the Board of Directors had to inform Ms. Leeper-Ford that there would not be an executive director in the forthcoming year. The Board of Directors were forced by the inability to secure funds to modify the administrative structure. Consequently, at the beginning of the 1990-91 school year, Dr. Jo Ann Lutz will be designated project director for the Council. This position will combine the essential duties of the director and the executive director's position. Dr. Lutz's time working with the Council will be an add-on to her other duties as chair of the mathematics and computer departments at NCSSM.

There were some instances of notable progress during the year. The Board of Directors of the Durham Mathematics Council and its chair were committed to the collaborative and continually provided support. The group met regularly and individuals gave their time and energy to resolving the issues facing the Council. The Board set a good example in its devotion to the collaborative and in its willingness to act as the collaborative's advocate with the host agency and assist in finding a suitable location for the collaborative. Barbara Davis, the DMC secretary since October of 1985, has been the one person to survive the many changes. She has provided continuity and a knowledge of the collaborative's history. She is the person to whom people turn to seek information about the collaborative. She maintains four bookkeeping records--one for the state, one operated through the NCSSM business office, the Council's bookkeeping system, and one for the Ford Foundation. The collaborative funds have actually been divided into two accounts, each with a separate budget. One is a state account that pays for salaries and travel. A second is the Fund for the Advancement of Science and Mathematics Education in the State of North Carolina. The latter is administered by NCSSM and is used to account for funds used for activities. Ms. Davis handles the publicity for events, including the monthly newsletter, which is sent to 375 people. About 25 percent of her time is spent on the budget, 40 percent on communication, 25 percent on coordinating activities, and 10 percent supporting the committees. She assumes responsibility for reminding teachers of deadlines and planned activities on an on-going basis.

Having an executive director who is not associated with the NCSSM has had both a positive and negative impact. The two previous executive directors, who were on the NCSSM faculty and situated on campus, actually devoted more than half time to the position. One reason for this was accessibility. Ms. Leeper-Ford, spending the mornings at Hillside High School, divided her time between her teaching in the morning and working for the collaborative in the afternoon. As a result of this schedule and the fact that she was not appointed until the end of October, less time was spent by the executive director on the collaborative during the school year. This meant that high priority items were addressed, but there was less opportunity for time-consuming tasks such as visiting schools and personally working with teachers.

The events affecting the life of the DMC that occurred during 1989-90 illustrate how vulnerable collaboratives can be, particularly those housed outside an education funding structure. Changes in personnel and in current trends and/or conditions can have a dramatic impact on the stability of the collaborative. The events of the year also indicate the importance of a strong Board that feels responsible for the collaborative and that has been involved in the development of the collaborative from its beginning. We are not referring to an advisory board, but a decision-making body that is actively involved in fund raising and the allocation of funds. Questions remain regarding the possibility of raising financial support in the Durham area that will be adequate to maintain the DMC. As the summer proceeds, support seems to be decreasing.

## Collaboration

The Durham Mathematics Council has developed a number of different forms of collaboration over its four years of existence. One form is the networking and sharing among teachers that comes out of the network meetings, Steering Committee meetings, and the Show and Share Conferences. A second form of collaboration involves the use of persons from business and higher education as resources for teachers. The IBM seminar and the workshop given by Arthur Powell were examples, during 1989-90, of this form of collaboration. The activities of the Board of Directors represent a third form of collaboration--bringing people together from different groups to engage in decision making and planning. At Board meetings, all who attend participate on an equal level, unlike workshops and seminars where other education or business professionals provide information to teachers. A fourth form of collaboration, another interactive form, is socialization across the sectors, which occurs at receptions or at social events such as the Kick-Off Reception. In previous years, the Triangle Math Club also offered programs that functioned as interactive forums where people could associate with those from other sectors.

The variety in the forms of collaboration orchestrated by the DMC has resulted in multiple impacts on teachers. The most consistent outcome reported is the increased interaction among teachers, not only within a school but also across schools, within a district, and across the two districts. Through this expanded, referenced group, teachers have gained new ideas for use in their classrooms and are more conscious of what other teachers are doing; thus they have a sense of a standard for their own teaching and are finding more opportunities to help other teachers. One high school geometry teacher noted that she is much more aware of helping new teachers at her school to acclimate to its routine because of the support she herself has received from those in the collaborative. Another teacher has benefited from talking with other teachers at national conventions. This has helped to reduce her sense of isolation. "It is kind of nice to find out that they're having the same kind of problems you are," she commented. She continued, "If you find out others are having problems too, you do not feel like it is your fault." The workshops and seminars presented by people from business and higher education have increased teachers' new knowledge of the use of technology in their classrooms and their awareness of the importance of having their students write more within the context of the mathematics classroom.

The DMC has also provided the mathematics teachers in the Durham area with an advocacy group, namely the Board of Directors. This group has engaged in fund raising on behalf of the Council and teachers, but it has also made certain demands on its constituency. For example, Ms. Leeper-Ford was asked to provide data on the number of teachers participating in events and on the total number of teachers taking advantage of DMC activities. At least one member of the board of directors, Dr. Bunch, reflecting on teaching and contrasting what is required of teachers compared with personnel in his firm, noted that he is not required to do a follow-up report upon returning from a conference or workshop and wondered why teachers should be. This response eventually led to dropping the requirement that teachers who receive a DMC conference grant report on what they learn. However, teachers do, on their own initiative, report back to other teachers in the Show and Share workshop.

Collaborative teachers have a sense of being less isolated. This is a result of their getting to know other mathematics teachers and interacting with them as noted above, but it has also come about because they have greater access to the administration. A few of the teachers interviewed reported that their administrators, both at the school level and district level, are giving them more recognition. The fact that the districts provide release days for mathematics teachers is one example of the districts' recognition of their mathematics teachers. The idea of collaboration has not been adopted by the districts and used with teachers in other content areas. This surprised one member of the DMC Board of Directors who thinks that the idea of collaboration would benefit those in other areas beside mathematics. At least one principal has acknowledged the possibility; a teacher reported that her principal would like to see a collaborative in science, history, and English. She reports that the teachers in these content areas are jealous of the mathematics teachers. The principal's support of the mathematics collaborative was evident when he interviewed new teachers for the mathematics staff and encouraged them to become involved in the Durham Mathematics Council.

The delay in appointing an executive director at the beginning of the school year had an effect on a number of activities held during the year and the number of teachers participating in those activities. The Kick-Off Reception was held December 5, 1989, whereas in 1988 it had been held on September 28. In the previous year, two of the network groups met five times during the year. Attendance at the 1988-89 meetings of the three most active networks ranged from 6 to 11 at five meetings for one network, 4 to 15 at five meetings for another one, and 2 to 20 at three meetings for the third one. By contrast, the highest level of attendance at any network meeting during the 1989-1990 school year was 19 teachers at the general meeting of all of the networks, held in November. Of the six other network meetings held during the year, the largest number of teachers attending was eight. At the last Geometry Network meeting, no one attended. Also during the school year, there was no meeting of the Triangle Math Club. One teacher, who was less active in the collaborative in 1989-1990 but who had been very active in the previous two years, commented that by the time the collaborative got started this year she had already committed herself to other activities such as prom advisor.

The decline in momentum was evident throughout the year. The late appointment of the executive director was one factor. In addition, the change in executive directors was not as smooth as had been the case when the incoming and outgoing executive directors both taught at the NCSSM. Another difference during the year was the decline in personal attention given the teachers by the executive director. Not as much of the executive director's time was spent in the schools visiting teachers. No one identified this as a real issue, but it could have been a factor in the level of participation of teachers. These factors indicate the importance of an integral support system for maintaining the DMC.

A solid core of between 15 to 20 teachers are very committed and active in the Durham Mathematics Council. Many of these have a position of leadership in the Council, serving either on the Steering Committee or on the Board of Directors. Another eighty teachers have participated in the collaborative by applying and receiving grants or by attending one of the activities. Those teachers who have participated in the DMC speak highly of it and the benefits they have gained from being more closely associated with fellow DMC teachers. The future of the DMC and the forms of collaboration it will resort to in the future seemed to be in question at the end of the school year. Part of the issue is the quality of leadership the mathematics teachers themselves are willing to assert to maintain the collaborative. Up to this point, teachers have depended on the executive director to get things done.

### Professionalism

The Durham Mathematics Council has had an impact on the professional development of mathematics teachers in the Durham area. Such impact is the result of teachers being more active professionally in attending workshops, conferences and meetings; of teachers supporting each other more through networking and cooperating on curriculum development; of teachers having access to the latest trends in mathematics education and business; and of teachers assuming leadership positions in conducting workshops or chairing committees. Teachers who have participated in the DMC report that they have experienced increased self-esteem in response to being treated as professionals. That is, the workshops given by DMC are of very high quality, lunch is served when attending a business seminar, and nationally recognized people participate along with the teachers.

Six teachers, three who are frequent participants in DMC and three who have been occasional participants, were asked questions on a Diary of Professional Relationships Survey regarding teaching as a profession. From their responses, it was evident that teachers in the Durham area do not have very much involvement in evaluating other teachers. Two of the six teachers felt that they as teachers should be more involved and that there should be more constructive criticism. Currently, teachers give each other encouragement, support, and help when asked. Only department heads and mentor teachers will evaluate new teachers; the other teachers do not engage in monitoring the quality of their reference group.

The DMC teachers consider themselves teachers rather than mathematicians. Two of the teachers indicated that this was due to the fact that they taught the lower level, basic mathematics which did not require doing mathematics. Two teachers felt that the reasons for teaching mathematics went beyond students learning mathematics, that it was more directed toward preparing students for life. One teacher responded, "To me, content is not the end, it is the means." This implies that in identifying with a professional group, the teachers are more apt to relate to other teachers than to expand the group to include mathematicians or mathematics users in business and higher education.

The DMC teachers viewed their role in society as providing general knowledge to their students. One teacher had made a commitment to help students overcome their fear of mathematics. Another felt that giving students the ability to think logically is the unique contribution of mathematics teachers to society. A third teacher observed, "We offer more exactness. Mathematics offers a concrete way of problem solving. We stress logic and thinking skills. We emphasize how to organize known facts and find the unknown from them." Only one of the six teachers noted some motive for providing knowledge to fulfill career choices, and this had to do with making students aware of fields that use mathematics in daily life. None of the six teachers commented on educating young people to become engineers, scientists, or mathematicians.

One effect the collaborative has had on participating teachers as professionals has been to increase their own confidence and develop a new perception of themselves. One teacher verbalized the problem, "It's hard to maintain the view of yourself as a professional when it's just you and 110 kids day after day." The collaborative, through providing positive, reinforcing, and gratifying experiences, has affected the way in which teachers think about themselves. "It has basically improved my morale and helped me see myself as an important person not only to my students and to myself but also to the community," noted one of the occasional participants. Important to this change in self-image is the support teachers have gained from other teachers and from those in the community. One teacher reported participating in professional mathematics groups prior to her involvement in the collaborative, but still not finding anyone to talk to about teaching mathematics. For her the collaborative has increased her understanding and her capacity for risk-taking, "I know I wouldn't have tried some things or understood them as well as I do now just because of having the meetings to go to to discuss them."

Related to teacher professionalism, one emphasis of the UMC project is leadership. Two of the DMC teachers attended the Teacher Leadership Workshop conducted by EDC in Newton, Massachusetts, in August, 1989. These teachers and four others were asked questions about teacher leadership. For them a teacher leader was one who was knowledgeable about mathematics and the latest trends in the field. A teacher leader also interacts with teachers by serving as a role model, sharing information, and supporting other teachers. Teacher leaders have high expectations, are willing to take risks, and participate in activities. Teachers who fulfill the role of leaders have good listening skills, are good decision makers, serve as catalysts in getting things done, belong to professional organizations, and serve as chairs of committees.

The mathematics teacher leaders in the districts are generally active in the Durham Mathematics Council, but not always. Of the six teachers who responded to the question on leadership, three said the teacher leaders were active and three said the leaders were somewhat active. All six teachers felt that the DMC has supported and encouraged teachers to be leaders by promoting their attendance at meetings, sending teachers to leadership training, and providing small grants for teachers to develop their own ideas. The collaborative has effected the development of leadership qualities in all six of the teachers. This can be attributed to an increase in self-confidence as a result of knowing more about mathematics, being more current on the latest trends, interacting with people who are prominent nationally, and receiving more stimulation for teaching. One of the teachers who had attended the Leadership Conference articulated the point in this way, "[The collaborative] has given me the opportunity to see myself through others' eyes and to discover how they perceive me. I find myself much more assertive in group discussions. The workshop on leadership at Boston helped me a great deal, particularly the sessions on active listening and networking. I have made productive attempts to implement these ideas and have found that they have changed my perception of myself as a leader." Another teacher interviewed at a different time reported that teachers affiliated with the DMC are perceived by administrators as being leaders.

Teachers participating in the DMC have expressed the need to get more mathematics teachers involved. However, there has not been much initiative shown by teachers to develop this involvement. Members of the Steering Committee who attend those meetings do encourage participation of teachers from their schools. However, most of the work in getting and keeping teachers involved seems to center on the executive director.

## Mathematics Focus

The activities of the Durham Mathematics Council during 1989-90 again touched on a wide range of areas in the school mathematics curriculum. The Council's program is well structured so that teachers are encouraged to participate in workshops and seminars in Durham and in other locations and then to write proposals to seek funding for the purchase of innovative materials they have been introduced to. During the year, teachers had the opportunity to learn more about implementing the NCTM *Standards*, graphics calculators, data analysis, hands-on activities for geometry, statistics, using writing to reveal students' thinking, equity, working with the unprepared and unmotivated student, educational software, end-of-year testing, and Napoleon geometry. The Resource Center enables teachers to borrow classroom sets of calculators or try new software. There has been a range of topics addressed with special emphasis on the use of technology and the development of students' capacity to think.

The experiences that the teachers have had through the Durham Mathematics Council, in 1989-90 and in previous years, are making some impact on the mathematics curriculum.

This is particularly significant for teachers in North Carolina because of the strong control exerted by the state over what is taught through textbook requirements and end-of-year testing. "We have little impact on deciding course curriculum. The state decides what we must teach through the use of end-of-course tests," reported one teacher. Another teacher complained, "We teach a lot of things that I don't think are important any more, especially now with calculators around. But you have to teach it . . . like our 8th-grade general math curriculum. . . .that's a total rehash of what the kids have done for the last three to four years."

Teachers do have some responsibility for providing enrichment activities and going beyond the textbook. During the summer of 1989, one teacher attended an institute on statistics in Illinois. Because of that experience, statistics is being added to the Introduction to High School Mathematics course at her school. The Durham Mathematics Council provides a force that can be applied to make such changes happen. In addition to addressing the issue of major change, the collaborative has provided activities that give teachers ideas that they can immediately apply in their classrooms. One teacher who attended Arthur Powell's Writing in Mathematics Workshop reported, "I went to the morning session and I came back to my afternoon class and did it with them that afternoon. It really did work! The kids loved it!" A middle school teacher stressed, "I am worried about whether [students] are getting the idea. I am trying to prepare them for the real world . . . give them floor plans of houses and let them plan houses. [These are] ideas I didn't have before that I got from the Math Council." He continued, "I am drawing from different ideas I got them from the Council and putting together more units that are more hands-on and active. . . .[The Council] helps me generate ideas of my own too."

Some teachers reported learning more about how mathematics is used in industry. In discussing the benefits of the collaborative, a teacher said, "One thing most beneficial is how math is used in industry. At the [Woodrow Wilson] workshop in Columbus, Georgia, each day they had someone come in from a different company to talk to us about how they used statistics and probability and what they train their people to do. That was really great!"

Being associated with the North Carolina School of Science and Mathematics and its faculty of nationally-recognized teachers has been important to the DMC teachers. "I think it is an interesting place. It has a lot of resources--computers, classrooms, and teachers who can help us," one teacher confessed. He went on to comment, "I have misgivings about moving out of the School of Science and Mathematics. I think that it is a good place to be." The association with the NCSSM has helped, along with other factors, to increase the teachers' sense of being well-informed and on the cutting edge. A department head responded to a question about how the collaborative has enhanced her professional life: "I've met lots of math teachers and mathematicians. I've heard lots of speeches and have been to workshops. It has been a very exciting time, in math anyway. I'm very aware of all the literature coming out. I know people who write for national magazines. I have seen many of them on the School of Science and Mathematics campus, or at talks or workshops. I have been in seminars with them or sessions on mathematics connections. The collaborative has helped me realize that there has been a great explosion in the area of mathematics."

The awareness of what is happening in mathematics education has been raised in the minds of teachers who have been active in the Durham Mathematics Council. Teachers are using technology more and view the goals of teaching mathematics differently. Mathematically, the Durham Mathematics Council has made a difference for at least some of the teachers in the Durham area in how they teach and, in some cases, what they teach.

## F. Next Steps

Dr. Jo Ann Lutz will serve as the newly designated project director for 1990-91. The DMC Finance Committee has recommended that before a budget can be prepared for the 1990-91 school year, objectives and program goals should be reviewed. A survey of teachers is being conducted to determine which activities are the most useful to them, so that future activity scheduling will include their preferences.

From July 2 to 13, 1990, a Contemporary Pre-Calculus workshop was held on the NCSSM campus as well as a Woodrow Wilson Geometry Institute from July 16 to 20, 1990. A Statistics Workshop, conducted by Cheryl Brothers, was held August 8-9, also on the NCSSM campus. Two teachers, Verdrey Madzimoyo and Regina Smith, will attend the UMC Teacher Leadership Workshop in New Hampshire in August, 1990. For the first time, elementary teachers may be included in a DMC-sponsored workshop. A mini-conference, which had been scheduled for May and subsequently canceled, has been rescheduled for the fall of 1990. Conference presenters will be teacher colleagues who have attended DMC-sponsored conferences and institutes. The DMC and the Math Science Education Center at NCSSM combined efforts in submitting an Eisenhower Grant Proposal to sponsor a one-week Woodrow Wilson Algebra Workshop during the summer of 1991.

A DMC opening reception has been set for September 6, 1990, from 4:30 p.m. to 6:30 p.m., at the Durham Hilton. The guest speaker, Susan Friel, Director of the Mathematics and Science Education Network, University of North Carolina at Chapel Hill, will speak on the new NCTM Teaching Standards. A total of 91 teachers, business people, and higher education representatives will be on the guest list.

The relationship between the DMC and the Durham County Schools will change. Rather than providing the Council with a designated amount for a contribution, the County schools will provide financial assistance for Council activities, event-by-event.

# SUMMARY REPORT:
# LOS ANGELES URBAN MATHEMATICS/SCIENCE/TECHNOLOGY COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Los Angeles Urban Mathematics/Science/Technology Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to improve the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Los Angeles Urban Mathematics/Science/Technology Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October; 1989 meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

# LOS ANGELES URBAN MATHEMATICS/SCIENCE/TECHNOLOGY COLLABORATIVE

## A. Purpose

+PLUS+ (Professional Links with Urban Schools) constitutes the Los Angeles Urban Mathematics Collaborative. It is the goal of the +PLUS+ project to broaden teachers' mathematical horizons by encouraging them to interact with their colleagues in a mathematics resources network, and to help them relate the mathematics curriculum to the world of work. It is expected that teachers will benefit from expanded horizons and increased interaction with their colleagues. +PLUS+ activities during the 1989-90 school year included an expansion and continuation of those cited in the original funding proposal: networking and collaboration among teachers and among mathematics departments; the expansion of mathematics resources to encompass increased state and national resources; the development of team-building and leadership skills among mathematics teachers; and additional opportunities for teachers to develop, evaluate, and integrate new materials and methods into the curriculum.

+PLUS+ activities are directed toward achieving four objectives:

1. To broaden the scope of teachers' knowledge about mathematics and its applications in industry and research;
2. To provide opportunities to develop, evaluate and integrate new materials and methods into the curriculum;
3. To provide team-building and leadership training to enhance the professional status, and effectiveness of teachers; and
4. To create a collaborative network of teachers, mathematics departments and resources within Los Angeles, the State of California and the nation.

+PLUS+ is one of four professional development programs for teachers of the Los Angeles Educational Partnership (LAEP). Target Science develops and strengthens a professional environment for teachers in order to support science education for historically underserved minorities in selected K-12 schools and science centers. HUMANITAS works with teams of teachers at different grade levels to provide a thematic, interdisciplinary, writing-based approach to instruction in the humanities. Industry Initiatives for Science and Mathematics Education (IISME), in existence since 1987, places secondary mathematics, science, and computer science teachers into business, industry, and research laboratory environments during six- to eight-week internships, encouraging them to expand their knowledge of up-to-date concepts and technologies in their chosen fields. Peggy Funkhouser is the president and executive director of LAEP. A 30-member Board of Directors provides guidance and sets policy for LAEP.

The Los Angeles Educational Partnership's Mathematics/Science/Technology Council, which formerly constituted the collaborative under the aegis of LAEP, was reformulated by a small advisory group during 1989-90. The mission of the group is to stimulate stronger citizenry by promoting greater awareness, understanding and skills in the areas of mathematics, science, and technology on the part of K-12 students and teachers. The Council will seek, and seize, opportunities to improve student achievement by promoting and initiating educational reform mathematics, science, and technology. The Council serves LAEP's +PLUS+, Target Science, IISME, and the Model Technology Schools programs. The Council is to be comprised of representatives of ten to fifteen corporations that represent a cross-section of Los Angeles area mathematics/science and technology interests. Although the structure of the group was specified by July, 1990, the Council in its revised form had not been reconstituted.

## B. Context

Los Angeles County covers 4,083 square miles and has a population of 8,407,440. The county is maintaining a rapid growth pattern that is characteristic of the State of California as a whole. It is projected that by the year 2000, the number of school-age children in California will reach 8,700,000, up from 7,300,000 in 1988, at which time social changes, trends, and indicators reveal additional challenges for educators. Currently, 60 percent of Los Angeles County's children are from homes where both parents work, which allows little parental contact during the day. An increase in numbers of "latchkey" children emphasizes the need for adequate before- and after- school day-care programs for children. Los Angeles schools are trying to provide facilities to meet this demand for day care.

In Los Angeles County in 1980, 18.2 percent of all Hispanic families and 20.9 percent of all black families were living in poverty; 9.9 percent of all Asian families and 7.2 percent of all white families were also at or below the poverty level. Socio-economic background and poverty have been found to be reliable predictors of school dropout rates. Los Angeles County records indicate that more than two thirds of the students who drop out of school during grades 10, 11, 12 are from black or Hispanic families. Urban schools are experiencing the effects of greater enrollments of linguistically, culturally, and ethnically diverse populations. Eighty percent of the 600,000 legal immigrants to the United States annually are Latin American and Asian. Many have suffered the ravages of war and oppression prior to their arrival. Schools are being challenged to meet the needs of these non-English speaking children of immigrant families and to make them feel part of their new communities. Educational studies have shown that students who feel alienated and anonymous are at a much greater risk of dropping out and they must be made to feel that school is a special communal place for them.

In 1967, California had a 78 percent white non-Hispanic population. Currently, only 59 percent is white; the percentage of non-whites in the state has nearly doubled over the past two decades. If the current trend continues, California will be a culturally diverse state with whites in the minority by the year 2007. Los Angeles County has already reached that status. Recent school statistics show that 44 percent of the Los Angeles County population is white non-Hispanic. That percentage is expected to decline to 32 percent by the year 2000.

Throughout California, 51 percent of public school enrollees are members of underrepresented groups. In Los Angeles County, 47 percent of public school students are Hispanic; 28 percent are white non-Hispanic; 14 percent are black and 8 percent are Asian. Many children from these groups do not speak English as their primary language. Forty percent of the public school children in the county come from homes where English is not the first language, and more than half of these are classified as Limited English Proficiency (LEP). Over 80 percent of the students with limited English have Spanish as their primary language--the number of LEP students whose first language is Spanish increased by more than 100,000 between 1980 and 1988.

The ethnic diversity among teachers in Los Angeles County does not match that of the student population. The county has 57,000 teachers, 70.7 percent of whom are white non-

Hispanic. The teacher composition by race for the county includes 12.8 percent black; 9.4 percent Hispanic; 5.6 percent Asian; and .7 percent American Indian. More than 71 percent of the county's students are from groups other than white non-Hispanic, but only 29.3 percent of the total teacher population can be identified as being in this group.

In Los Angeles County, changes are occurring at a brisk pace for both educators and students. Dr. Angel A. Sanchez, of the Los Angeles County Office of Education, recently wrote, ". . . Educators and leaders must do all they can to improve conditions for children by transforming schools into meaningful sources of stability in the lives of young people."

During the 1989-90 school year, there were +PLUS+ departments in four school districts: Los Angeles Unified School District, (LAUSD), Inglewood Unified School District (IUSD), El Monte Union High School District (EMUHSD), and Long Beach Unified School District.

## Los Angeles Unified School District (LAUSD)

The Los Angeles Unified School District serves a population of 4,021,333 and covers a 708 square-mile area. Within the Los Angeles district, there are 652 square miles on the mainland and 56 square miles in uninhabited offshore land. The district includes 469 square miles of the city of Los Angeles and the eight cities of Cudahy, Gardena, Huntington Park, Lomita, Maywood, San Fernando, Vernon, and West Hollywood. In addition, portions of 19 other cities, as well as unincorporated areas of Los Angeles County, fall within the district's boundaries. It is the largest school district in California and ranks second to New York City nationally.

Dr. Leonard M. Britton, who has served as superintendent of schools for the past four years, receives an annual salary of $164,000; in July, 1989, his contract was renewed for the year 1990-91. The seven-member school board is headed by Jackie Goldberg.

A teachers' strike, settled in May, 1989, resolved the wage dispute at issue, but other issues such as teacher professionalism and school-based management became part of a continuous educational dialogue within the system. Board President Goldberg stated that one objective of the teachers' contract is to move toward school-based management. In the first phase, schools will use shared decision making. After each school comes up with a successful shared-decision plan, it will be allowed to progress in the sequence that leads to school-based management.

During the 1989-90 school year, the Board of Education re-examined its no-fail policy as it related to extracurricular student activities. Board members voted on January 22, 1990, to eliminate the "no-fail" portion of the district's "C-average/no-fail" policy. The policy required students in grades 4-12 to maintain at least a C average and a passing grade in all courses in order to participate in extracurricular activities. A district study on Program Evaluation and Assessment indicated that the no-fail portion of the policy discourages students from taking academic electives for fear of losing eligibility to participate in extracurricular activities and that consequently fewer of these electives may be offered. The study also showed that principals, teachers, counselors, sponsors, students, and parents all feel that the no-fail policy has had a positive influence on student achievement.

In a community outreach effort, the Los Angeles Senior High Schools Division (SHSD) sponsored a College Awareness Night series that was held throughout February, March, April, and May at 24 high schools. "Make College Part of Your Child's Future Now," the theme of the series of free evening programs for parents of elementary through high school students, was designed to help parents envision a future for their children that includes higher education. Parents were encouraged to bring their children, no matter what age or grade level. According to SHSD Assistant Superintendent Dan Isaacs, one of the major goals of the program is to increase awareness among district parents that it is never too early to plan on college for their children. To meet that goal, workshops were presented on how to instill in children the value and importance of getting a good education; how to become more involved in children's schooling; and how to help children develop effective study skills early, including creating a home environment conducive to good study habits. Workshops for parents of older students featured discussions on helping high school students select a college preparatory curriculum, evaluate higher education options, and deal with admission requirements and methods for financing a college education. The long-term goal of the series is to increase the number of district high school graduates attending college, particularly among underrepresented groups. The series is an outgrowth of a successful pilot project during 1988-89 at Lincoln High School, which attracted 800 participants.

Total LAUSD expenditures for the 1989-90 school year were $3,868,748,957. Approximately 75 percent of budget income is provided by the state; 10 percent is provided by local taxes (controlled by the state); federal aid accounts for almost 10 percent, and the balance comes from a variety of sources. Nearly 72 percent of all district expenditures are for salaries and benefits of certificated and classified employees. The annual per-pupil expenditure is $3,680.

Passage of Proposition 13 in 1978 put a ceiling on property taxes at one percent of market value except for amounts required to retire voter-approved bond issues. The State of California determines the Los Angeles School District's share of the one percent general tax levy. Los Angeles School District taxes are permitted, as needed, to repay bonded indebtedness and state construction loans. In 1988-89, the district tax rate was 1.1 cents per $100 of assessed valuation, with valuations stated as 100 percent of full cash value.

LAUSD is divided into eight regions, and four divisions that include a senior high schools division, an adult and occupational education division, a child development division, and the division of special education. Each region and division is headed by a superintendent or director and includes elementary, junior high, and magnet schools within a specified geographic location. The senior high schools division is headed by a superintendent.

The total LAUSD enrollment during 1989-90 was 806,324, distributed among 648 schools and 189 centers. There are 414 elementary schools, 72 junior high schools, 49 senior high schools, 43 continuation high schools, 26 community adult schools, 18 special education schools, 20 magnet schools, and 6 opportunity high schools. Inflated enrollments have caused overcrowding and prompted Dr. Britton to announce publicly that in the next two years, the district will need 19 new elementary schools, 3 new junior high, and 6 new high schools, for a total projected cost of over $1,000,000,000.

Included in these district totals are 105 year-round schools and centers: 81 elementary, 3 elementary magnet, 9 junior high, 4 senior high, 3 continuation high schools, 2 opportunity centers, 1 newcomer center, and 1 primary center. Each school and center followed one of five year-round calendar options during 1989-90. Three year-round calendars, referred to as "45/15," "60/20," and "90/30" provided 180 days of instruction, the same as the traditional calendar. The "Concept 6" and "Concept 6 Modified" calendar options provide 163 days of instruction, with each instructional day lengthened by 21 minutes at the kindergarten level to 39 minutes for secondary pupils, in order to provide instructional time equal to those schools in the traditional calendar. The significance of year-round schools is exemplified by Bell High School. In September, 1989, State Superintendent of Schools William Honig visited Bell High School, a +PLUS+ school, to cite it as a successful year-round high school. Honig honored Bell High School for its accomplishments in year-round education programming despite overcrowded facilities.

Approximately 45 percent of the total of all students in Los Angeles County are enrolled in LAUSD schools. In 1989-90, LAUSD experienced a 1.75 percent increase in student enrollment over the 1988-89 school year, which exceeded the projected enrollment growth for 1989-90 of 10,800 students. K-12 enrollment figures for 1989-90 were: elementary level, 331,317; junior high school, 120,614; senior high school, 120,743; magnet schools and centers, 28,717; schools for the handicapped, 3,989, and opportunity and continuation schools, 4,769, for a total of 610,149. The remaining 196,175 of the total 806,324 enrollment comprises the adult schools, skills centers, and children's centers population.

In the fall of 1989, there were 124,299 students enrolled in senior high schools and opportunity schools. The population was: Hispanic 57.8 percent (71,877); white 17.5 percent (71,877); black 14.8 percent (18,434); American Indian .3 percent (392); Asian 7.3 percent (9,135) and Filipino 2.2 percent (2,722). Within the district, there were 162,710 students who were classified as Limited English Proficiency (LEP). The largest group (K-12) was Spanish-Hispanic speaking, at 145,656, followed by Korean-speaking students at 3,260.

Statistics released by the California Department of Education in the fall of 1989 showed a 39 percent dropout rate. The dropout rate is a percentage calculated by totaling the number of dropouts in the 10th-grade in 1985-86, the 11th-grade in 1986-87, and in the 12th-grade in 1987-88 and then dividing that number by the total 10th-grade enrollment in 1985-86. Dropouts include students who left school after entering the 10th-grade and who did not receive a high school diploma or equivalent.

Statistics on all LAUSD high schools show that an average of 15.48 percent of all high school students are from families who received AFDC in 1989-90. The averages in the 20

+PLUS+ high schools in Los Angeles reached 26.24 percent of all students whose families received AFDC monies. Jordan High School at 73.02 percent had the highest average of secondary school students whose families received AFDC, followed by Fremont at 58.85 percent. Both high schools are +PLUS+ schools.

During 1989-90, 7,947 juniors and seniors were enrolled in advanced mathematics courses. One year of mathematics in grades 10-12 is required for high school graduation. Of the 1989 graduating seniors, 37.3 percent had completed all courses, including three years of mathematics, required for admission to the University of California. As part of a district effort to improve preparation for college, Phoenix High School, a continuation high school, is offering its students two new courses in advanced mathematics, designed and taught on Wednesdays and Fridays by Michael Pomerantz, a volunteer teacher, who is retired from Venice High School, a +PLUS+ school. Wilson High School, also a +PLUS+ school, has experienced a significant increase in the number of students who take advanced placement (AP) exams. Encouraging more students to enroll in AP classes and to take the AP exams has been a primary goal of educators in LAUSD. In May, 1989, 102 candidates took 152 exams. Since 1983, the number of students taking AP exams has nearly doubled, making a strong impact on the structure of the AP program. For the sixteenth time in the past 19 years, and the tenth year in a row, LAUSD students have exceeded the national average; 14 percent of all LAUSD students who took the tests scored a 5, the highest possible score, compared to 13.4 percent of national students who scored 5.

SAT scores for high school seniors in 1989 indicate that 10.7 percent scored 450 or above on the verbal portion and 14 percent scored 500 or above on the mathematics portion. CTBS/U District-Estimated Median Percentile Scores in mathematics in the spring of 1989 were: 9th-grade, 44th percentile; 10th-grade, 46th percentile; and 11th-grade, 48th percentile.

The California Assessment Program (CAP) testing has generated interest in both educational and business circles. For the fifth consecutive year, the Northrop Corporation presented $1,000 grants to district high schools for improvement in CAP mathematics scores. Franklin High School raised its mathematics score by 14 points on the CAP over the previous year and University High School raised its score by 28 points. Both schools received a $1,000 award for achieving improved scores. It was the first year that Northrop also awarded $1,000 for improved science scores. Crenshaw and Manual Arts High

Schools were honored for their improved science scores. All four schools are +PLUS+ schools.

In 1989-90, LAUSD employed 30,428 teachers, 4,212 other certificated staff, and 24,703 classified (non-teaching) employees for a total of 59,343. The district also employs part-time, substitute, and relief personnel. This impressive employee total gives LAUSD the distinction of being the fourth largest employer in the immediate five-county area. Figures released in 1989 indicate that the average age of an LAUSD teacher is 44, with 15 years of service overall, and 14 years of service in the district. Thirty-one percent of all teachers are male.

In May, 1989, a three-year contract was approved after 15 months of negotiations and a two-week strike. The first-year salary of the contract period (1988-89) was paid retroactively; the second-year salary was begun in the fall of 1989, and the third year of the salary contract will encompass the 1990-91 school year. The contract base increases by 8 percent for each contract year. Teachers from nearby districts were attracted to LAUSD by the new salaries, thereby causing teacher shortages in neighboring districts in the fall of 1989. Inglewood lost approximately 200 teachers. In a separate action, the LAUSD board approved a two-year (8-8 percent) increase for top management. Middle management (principals and vice principals) received an (8-8-8 percent) increase awarded over three years. In 1989-90, the minimum teacher salary with a BA/BS was $27,346, the maximum $50,123. In the fall of 1990, the minimum salary will be $29,529, with an average of $45,709 and a maximum salary of $53,938 for 180 contract days. Approximately 70 percent of all teachers are members of United Teachers-Los Angeles (UTLA), which is the bargaining agent.

LAUSD employs approximately 800 high school mathematics teachers, 80 percent of whom are tenured. Sixty-eight percent are male, with the mathematics teacher ethnic population as follows: 65.6 percent white, 14.9 percent black, 7.2 percent Asian, 11.1 percent Hispanic, and 1.2 percent American Indian. Approximately 98 percent have a bachelor's degree; 38 percent have a master's; and 85 percent are certificated to teach mathematics. The remaining 15 percent hold short-term emergency certification.

**Professional Development Opportunities for Teachers**

Several professional enrichment opportunities in the district were provided during the 1989-90 school year. The LAUSD Office of Secondary Instruction, the UCLA Mathematics Project, the Center for Academic Inter-Institutional Programs (CAIP), and the UCLA Graduate School of Education cosponsored a professional development workshop series, "Secondary Mathematics: Preparing for the 21st Century," held on March 17, 31, April 28, and May 5, 1990. Presentations at the four half-day workshops for teachers in grades 6-12 were made by teachers from the UCLA Mathematics Project Advanced Institute.

District mathematics education leaders were selected to attend a regional conference, held in San Jose on January 11-13, 1990, "Leading Mathematics Education into the 21st Century." The California 21st Century conference was the first of five to be held across the nation. Others were held in Dallas, Chicago, Atlanta, and Hartford, sponsored by National Science Foundation (NSF) grants. Teams from 14 western states, British Columbia, and the Department of Defense schools met with representatives from business and industry, colleges and universities, the media, and national organizations such as the Mathematical Sciences Education Board (MSEB), to discuss the NCTM *Curriculum and Evaluation Standards* and ways of disseminating and implementing them. One team consisted of several +PLUS+ teachers who met during the summer of 1989 at UCLA's Mathematics Project Advanced Institute to set up a professional development series for secondary mathematics teachers. Board of Education President Jackie Goldberg served on a panel that discussed the Board's role within the school mathematics reform movement. The conference goal was to empower participants and others to be agents for change in the mathematics reform movement. As a follow-up, the group of educators from Los Angeles will meet with other educators from Los Angeles County to make sure that all area mathematics educators, as well as the general public, learn more about the *Standards*.

The Los Angeles City Teachers' Mathematics Association (LACTMA) held it's annual conference March 9 and 10 at Loyola Marymount University. During the conference, eight +PLUS+ teachers as well as the +PLUS+ director presented sessions, and three +PLUS+ teachers served as presiders. The fifty-minute sessions began on Friday at 5 p.m., followed by a keynote address by James Prekeges, Houghton-Mifflin, at 7 p.m. A wine-

and-cheese reception followed. Saturday sessions began at 8:30 a.m. and concluded at 3:50 in the afternoon. The general sessions for elementary and secondary teachers, which were held on Saturday, featured Tony Spears, president of CMC, and Susie Hakansson, director of the UCLA Mathematics Project, respectively. In addition, commercial exhibits were on display on Saturday. LAUSD inservice and university credit were available for teachers meeting the requirements.

The LACTMA Recognition Dinner was held on June 1, 1990, at Les Freres Taxis restaurant. Barbara Wills, +PLUS+ teacher coordinator, is the vice-president of LACTMA and helped organize the evening. Two +PLUS+ teachers, Alan Amundsen (Wilson High School) and Lorrie Freedman (Manual Arts High School), were newly seated on the Board of Directors.

The Expanding Your Horizons Conference was held on Saturday, March 24, 1990, on the Loyola Marymount campus. The annual event is sponsored by the Mathematics-Science Interchange of LMU. The conference is designed to expand awareness on the part of traditionally underrepresented secondary students (girls and racial/ethnic groups) of careers and applications related to mathematics instruction in the classroom. The conference consisted of both career awareness workshops and panel discussions, as well as hands-on activities for students and their parents/counselors, designed to demonstrate that these students can be successful in mathematics. Several PLUS+ teachers were represented on the program.

Three EQUALS Inservice sessions (A. October 24-25, 1989, January 16-17, 1990, and April 24, 1990; B. October 26-27, 1989, January 23-24, 1990, and April 25, 1990; C. June 18-22, 1990) were offered at the Lawrence Hall of Science, University of California (Berkeley) during the year. The focus of Project EQUALS is to increase the participation of young women and minority students in mathematics. Preference for acceptance is given to teams of two people from the same school. There was no charge for attending and no stipend awarded.

The Tandy Corporation announced a scholar program in September, 1989. The program recognizes outstanding mathematics or science teachers from high schools throughout the United States. A cash stipend of $2,500 is awarded to the top 100 educators for their contribution to future technological excellence inside and outside the classroom. In addition, the top two percent of high school students will also be recognized for academic excellence and each in the top 100 will receive a $1,000 cash scholarship. Tandy also supports an educational grants program focused on specific topics. Educators are encouraged to submit proposals in a grant application format. A dollar limit of $5,000 retail value is set for grant requests in the form of Tandy Computer hardware and software.

A Technology Leadership Academy presented by the California Technology Project (funded through the State Department of Education) was held on February 3, 1990, at the Alhambra Model Technology School in Alhambra. The day of workshops enabled participants to experience the latest developments in educational technology in a "hands-on" context, using classroom tools. The general session included an introduction to TRIE (Teacher Resources in Education), a no-cost data base and electronic bulletin board that allows teachers direct access to statewide educational resources. The system, which became operational in the winter of 1989, was demonstrated and participants received free password information. Information was also provided about AB 1470, pending legislation which would provide for school-site grants of $3,000-$50,000. Workshops at the Technology Leadership Academy included: HyperCard Basics, Desktop Publishing (IBM & Apple II), Video Production, Instructional Television, and Logo Writer. The finale was a Multimedia Workshop that provided information on controlling different media for students.

The Achievement League, a program of the Achievement Council established in 1989 to work with predominantly minority schools to raise achievement with a current emphasis on mathematics, sponsored a conference November 14, 1989, at the Midtown Hilton Hotel. The theme of the conference, which was the League's first activity, was "Mathematics Is Not an Unlisted Number: Equal Access for All." Phil Daro, executive director of the American Mathematics Project, delivered the keynote address, "Make Mathematics a Pump, Not a Filter." The conference, which was attended by almost 300 teachers and administrators from schools in southern California, included many +PLUS+ teachers from Bell, Crenshaw, Hollywood, and Manual Arts schools. Richard Curci, a former +PLUS+ mentor teacher who is currently affiliated with the Achievement Council and the collaborative on-site observer, presented a breakout session on Graphing Calculators, along with other mathematics educators who presented sessions on topics such as probability, statistics, algebraic notation, geometry, Math A, and the 1990 *Framework*. The use of manipulatives, cooperative learning groups, and open-ended questions was emphasized.

The Alliance for African-American Educators (AAAE) met at Crenshaw High School, a +PLUS+ school, on February 26, 1990. The Alliance was organized to address the needs of African-American school children in the Los Angeles area. The UMC and the AAAE share the same basic philosophy in addressing the issue of equity in education. The AAAE is in the process of publishing a lesson plan book which incorporates academic study and the study of African-American culture, morals, and values. George McKenna, Superintendent of Inglewood Unified School District, was the guest speaker and noted that out of the total number of black males who enrolled at USC in 1989, all except one was there on an athletic scholarship.

IBM and North Hollywood High School co-sponsored an open house at the high school on Wednesday, May 16, 1990, from 1 to 5 p.m. The open house featured K-12 courseware on mathematics, science, business applications, reading/language arts, Writing to Read, PALS (Literacy), networking, and laser disc technology.

During the 1989-90 school year, there were a variety of grants available to teachers in Los Angeles County, as well as opportunities for professional recognition. GTE sponsored a $12,000 grant program, GTE Growth Initiatives for Teachers (GIFT), designed to encourage innovation and teamwork in teaching mathematics and science. Seven thousand dollars was available for school enrichment projects integrating mathematics and science. In addition, teams comprised of one mathematics and one science teacher could apply for grants of $2,500 for professional development. GTE also hosted a week-long seminar in Washington, D.C., Massachusetts, and Connecticut for grant winners. In the 1988-89 school year, five mathematics-science teacher teams from LAUSD received grants.

Syed Multani, the mathematics department chair and +PLUS+ team leader at Fremont High School, won a TAAP (Teacher Achievement Award Project) Grant. The $5,000 grant, made available by the chancellor of Long Beach State University, was awarded to enable Mr. Multani to implement his project, "Learning by Doing." The focus of this program is to help students in basic mathematics and high school mathematics correct their deficiencies in a hands-on format with the help of manipulatives, and simultaneously to prepare them for higher mathematics classes.

On October 14, 1989, the LAUSD Commission for Sex Equity honored five women at its eighth Annual Awards Ceremony and luncheon at the Hyatt Wilshire Hotel. Mary Ann Sesma of Bell High School, a +PLUS+ school, was honored for being the writer-developer of PREP, a project to increase motivation and the academic preparation of minority students.

The Los Angeles business community also provides opportunities for educators and students in a variety of programs.

On November 18, 1989, an Academic Decathlon was held in the Los Angeles High Schools Division. Dan Issaacs, assistant superintendent of the division, stated: "We are very proud of the achievement of all our students at the Academic Decathlon--of the knowledge, discipline, and intense motivation that each demonstrated through the day's competition. We are also proud of all coaches whose daily work with and training of the students, even on weekends, have produced the outstanding results displayed on November 18, 1989. But the decathlon could not have occurred without the generous financial support of the Milken Family Foundation, Coca-Cola Bottling Company of Los Angeles, Northrop Corporation, Southern California Gas Company, the Daily News, the Kay Kamiya Family, Security Pacific National Bank, UNOCAL, and the Scantron Corporation and . . . the support and hard work of over 400 volunteers. . . .Among the volunteers from the community were several from Pepperdine University, Lockhead Corporation, and the Mathematics, Engineering and Science Association (MESA). This support for the decathlon from the community and from business and industry represents just one of the many ways in which the private sector and the community have invested in education. . ."

## Educational Partnership Week

Michael Milken, who acquired millions of dollars through the sale of junk bonds, and attorney businessman Richard Riordan assumed new roles for a day at 102nd Street Elementary School in Los Angeles. Riordan became a temporary principal and Milken taught mathematics classes for the day. The new roles were part of a Principals-for-a-

Day/Businesses program, Educational Partnership Week (March 26-30, 1990), promoted by the Los Angeles Educational Partnership, in conjunction with the LAUSD and LA County Schools and sponsored by GTE and KNBC-TV. LAEP has raised $10 million dollars since 1984 for such programs as cash grants for projects by teachers, an anti-dropout project, and new ways of approaching mathematics, science, and the humanities.

A variety of other contributions to education have been made by area businesses. The aerospace firm TRW, Inc., plans to donate $1 million over the next 10 years for a special mathematics and science high school at California State Dominguez Hills. KNBC news anchor Linda Alvarez filmed segments during the week for a documentary that was broadcast on April 11, 1990. One of the filming segments offered an opportunity to observe student interaction in the non-traditional geometry classroom of a +PLUS+ school.

Educational needs and concerns are being addressed on the state level by California's largest firms. The California Business Roundtable, embracing 100 representatives of the state's largest corporations, commissioned its own study of the education system and in 1988 came up with a broad reform proposal. Superintendent of Public Instruction William Honig has endorsed some of the resulting legislative proposals. Another business group, the California Educational Partnership Consortium, sponsored a conference on school reforms in April, 1990, in Sacramento. Los Angeles' Adopt-a-School Program, begun in 1978, is an expansion of Arco's hands-on liaison with the Tenth Street Elementary School downtown and has become the largest program of its kind in the nation. Superintendent Leonard Britton of LAUSD has sought additional corporate involvement, not for funding alone but for the purpose of stimulating reform and wider public support for the schools.

## Inglewood Unified School District (IUSD)

Inglewood Unified School District (IUSD) is the second largest of the four school districts participating in the Los Angeles mathematics collaborative. There are five people on the school board, elected for four-year terms. Dr. George McKenna has served as superintendent since 1989; he is under a five-year contract with an annual salary of $85,000.

During 1989-90, the district's 19 schools served 15,863 students from elementary through high school. The district has two high schools; one of them, Morningside High, is a +PLUS+ collaborative school. Morningside had a student population of 1,278 during the 1989-90 school year. The ethnic breakdown of that population was: 64.2 percent (821) black; 34.6 percent (442) Hispanic; .8 percent (10) Asian; .4 percent (5) white. Across the district, black students comprise 50.4 percent (8,000) of the total school population, followed by Hispanic students at 46.4 percent (7,363). Per-pupil average expenditure in the 1989-90 school year was $3,403.43.

At the two high schools during the 1989-90 school year, there were 617 seniors and 48 other secondary students. A total of 650 graduated from high school in 1988-89.

SAT scores for the class of 1989 revealed that of the number of students who took the examination, 5.4 percent scored above 450 on the verbal portion of the battery and 2.7 percent scored above 500 on the mathematics portion. Seniors have improved their mathematics percentages by .7 percent since 1984. The percentage of all County students who scored over 500 in mathematics was 16.6; statewide those who scored over 500 averaged 20.5 percent.

Inglewood's total professional staff numbers 676; the average age is 43. Total years of experience averages 16 with an average of 12 years in the IUSD. Seventy-four percent of the staff is female. Fourteen percent (95) of all teachers have a minimum of a bachelor's degree; 35 percent (237) have a bachelor's degree plus 30 credits; 15 percent (101) have a master's degree; 34 (233) percent have a master's degree plus 30 credits, and 2 percent (13) have a doctorate. The ethnic composition of all professional staff is: 48 percent (325) black; 41 percent (277) white; 6 percent (41) Hispanic; 4 percent (27) Asian; and 1 percent (6) American Indian.

Teachers are represented by the Inglewood Teachers' Association (ITA). Approximately 200 teachers left the Inglewood district for LAUSD, following the negotiated LAUSD settlement which was reached in May, 1989.

## El Monte Union High School District (EMUHSD)

The El Monte Union High School District (EMUHSD) includes the cities of El Monte, S. El Monte, Rosemeade, Temple City, Arcadia, and part of Los Angeles County, with a population of 150,000. EMUHSD has a school board of five people, elected for four-year terms. Superintendent Dr. James J. Sheridan has served in the position for over 15 years at an annual salary of $100,639.

The annual budget for 1989-90 was $70,162,371. Per pupil spending during 1989-90 was $3,864, lower than the County average of $3,960.37.

The district has four high schools and a continuation school for students 16 and over. One of the schools, Mountain View High School, is a +PLUS+ school. The high school has a student population of 2,155. The 1989-90 ethnic student population percentages are: 85 percent (1,831) Hispanic; 7.8 percent (168) white; 6.1 percent (141) Asian; .5 percent (11) American Indian; .2 percent (4) black. El Monte High School will join the +PLUS+ network in the 1990-91 school year.

Thirty percent of the student population qualifies as either Limited English Proficiency (LEP), or Non-English Proficient (NEP). During 1989-90, 1,699 or 18 1/2 percent of students' families received AFDC support.

The total number of high school graduates in the district in 1989 was 1,389. SAT scores in 1989 for those students who took the examination revealed that 5.3 percent of the students scored 450 or above in the verbal portion of the examination and 9.2 percent scored 500 or above on the mathematics portion. A variable dropout rate from 13.8 percent to 28.2 percent for the district's 10th- through 12th-grades has been provided by CBED.

El Monte's professional staff totals 394 with an average age of 43. Staff members have averaged 16 years of teaching experience with 13 years in the district. Fifty-nine percent of the total staff is male.

One percent (3) of the staff has not attained a bachelor's degree; 41 percent (162) have a bachelor's plus 30 credits, and 36 percent (142) have a master's plus 30 credits.

The ethnic composition of staff is: 73 percent (288) white; 20 percent (79) Hispanic; 4 percent (12) Asian; 2 percent (6) black; 1 percent (3) American Indian. For 1989-90, the minimum salary with a BA/BS was $25,289 and the maximum was $49,943. The teachers' contract is negotiated on an annual basis and has an expiration date of June 30. Teachers are represented by the District Education Association (DEA).

### Long Beach Unified School District

The Long Beach Unified School District draws from a population area of 476, 519 including Catalina Island. In 1989-90, there were 5 senior high schools (grades 10-12), one combination senior high and junior high school, 8 junior high schools, 6 middle schools, and 57 elementary schools. The district has one continuation school. The total 1989-90 K-12 student enrollment was 69,106 students. Of these, 31 percent were white, 29 percent were Hispanic, 19 percent black, 15 percent Asian, and 6 percent other. Of the 17,708 students enrolled in senior high schools, 35 percent were white; 25 percent were Hispanic, 19 percent were black, 14 percent were Asian, and 7 percent were in other ethnic categories. The certificated staff, including administrators, for 1989-90 consisted of 3,455 employees. The ethnic breakdown for certificated staff was available only for 1987-88, when there were 2,836 employees. Of these, 83 percent were white, 7 percent black, 5 percent Hispanic, 4 percent Asian, and 1 percent other. In 1987-88, about 10 percent of the juniors and seniors were enrolled in advanced mathematics classes. In the class of 1989, 11 percent scored 500 or higher on the mathematics part of the SAT. This compares to 17 percent of the class of 1989 in Los Angeles County and 20 percent for the state. In 1988-89, the per-student expenditure for the LBUSD, based on daily attendance figures, was $3,510.40, the 24th highest of the 42 districts in Los Angeles County.

## C. Development of the Collaborative

The project director of +PLUS+ is Toby Bornstein. She has a full-time program assistant, a position filled by Debbie Novick until her resignation in February, 1990, to work for a Hollywood casting and financial agent. Marlene Mercado-Rios was program assistant from February to mid-April, 1990. From mid-April until mid-August, program assistant duties were performed by temporary help. Kathy Blackwood, a teacher from

Venice High School, served as full-time teacher coordinator between March 8, 1989, and February, 1990, when she returned to teaching half-time while she continued to serve as teacher coordinator. When Ms. Blackwood returned to teaching, Joan Hairston, a mathematics teacher at Dorsey High School, assumed the half-time teacher coordinator position. As coordinator, she chairs the Teachers' Council and attends to administrative responsibilities for operating +PLUS+, including editing the monthly newsletter. The on-site observer was Richard Curci, a mathematics and mentor teacher at Morningside High School, Inglewood Unified School District. In October, 1989, he became a mathematics advisor to school teams of teachers and administrators for the Achievement Council and the TEAMS II project.

The +PLUS+ program serves more than 600 teachers of mathematics in 126 Los Angeles area schools. People who are considered associated with +PLUS+ are teachers from the mathematics departments that receive +PLUS+ grants, teachers who attend the +PLUS+ workshop series, and representatives from business and higher education who serve as associates. From 1985 through 1990, nearly 400 teachers have participated in the departmental planning grant program. At the end of the school year, there was a total of 29 +PLUS+ schools including the eight schools that joined in 1989-90. A total of 115 teachers from 74 schools in 10 districts within Los Angeles county participated in the 1989 +PLUS+ Workshop Series. Overall, almost 600 teachers from 83 schools in 4 districts have participated in some +PLUS+ activity since 1985.

+PLUS+ is a multifaceted program and its operation requires extensive administrative support. Some of the responsibilities assigned to the program assistant entail the planning and preparation of the +PLUS+ workshop series. The importance of administrative help with the workshop series cannot be overstated. The planning for each workshop series begins at the end of the previous year's series with the final evaluation that is used to determine what needs to be changed. The process becomes more complex with each increase in the number of workshops presented on a given day. The workshops series is only one component of +PLUS+ activities. The other components require as much if not more administrative support time. +PLUS+ has been fortunate to have found qualified staff. However, as the program expands, more assistance will be needed.

**Satellite Teachers' Councils**

The West Satellite Teachers' Council, formed in 1989-90, held its original meeting on February 5, 1990. Kathy Blackwood coordinates the West Council, which included representatives from five schools--Crenshaw, Dorsey, Morningside, University, and Venice. Venice High School provides clerical support for this group. The spring semester was considered a trial period for determining what is needed in the form of administrative support for such a council.

The West Satellite Council met a second time on April 2, 1990. Seven teachers attended and discussed mechanical problems with +TV, the responses to the UMC outreach grant, the Spring Conference, and changes in the Escalante awards process. The group felt that those applying for grants should be required to adhere to deadlines. One decision made by the group provided that departments that leave the +PLUS+ program and then return should be considered only for continuation grants and not for implementation grants.

The plan to form the three additional satellite Teachers' Councils was initiated after the May 4-5, 1990 Spring Conference. Originally, only the west area Teachers' Council was to be established during the 1989-90 school year, but the total group was too large to discuss issues and conduct business. At the Teachers' Council meeting on June 4, 1990, the teacher representatives divided into four groups by area and began making plans for their area Teachers' Councils. Each Teachers' Council is to be facilitated by a teacher coordinator who is to be released part-time to perform the duties involved. Each teacher coordinator will receive training by being released from teaching to serve as the teacher coordinator in the +PLUS+ office--as Kathy Blackwood and Joan Hairston did. Accelerating the formation of the satellite Teachers' Councils meant that not all of the teacher coordinators could receive uniform training.

At the June 4, 1990 meeting of the Teachers' Council, teachers met for the first time in the four satellite councils. This time was used to develop plans for their respective organizations. The West Area Council, coordinated by Kathy Blackwood, consists of teachers from the west side of Los Angeles, as noted above, including those from Manual Arts High School. The South Area Council, coordinated by Barbara Wills, includes teachers from Fremont, Huntington Park, Jordan, Bell, and Washington Prep. The East

Area Council, for which the coordinator is to be Alan Amundsen (he will be delayed in assuming these responsibilities because of another commitment), includes teachers from Wilson, Belmont, Mountain View, Hollywood, and Roosevelt. The North Area council, coordinated by Toby Bornstein, includes teachers from the Valley high schools, Cleveland, Verdugo Hills, Monroe, North Hollywood, and Francis Polytechnic. The satellite Teachers' Councils will have the power to make their own decisions regarding professional development grants, continuation grants, new school recruiting, classroom demonstrations, and resource teachers. The Teachers' Councils are to make their meeting minutes available on +TV and supply articles about their activities to the newsletter.

The West Council decided to request three auxiliary periods for three schools (Venice, Crenshaw, and Dorsey) to provide time for a teacher at each school to share in the responsibilities of running the satellite. This is in lieu of securing a half-time coordinator. The West Council will be meeting on the first Monday of each month, starting in September, 1990. Each satellite identified the date when continuation proposals had to be submitted by departments in their region. The dates set by the West Council was June 15. The South Council identified July 30. The other two satellites specified later dates.

## Teachers' Council

The Teachers' Council is the major decision-making body for +PLUS+. It is designed to promote leadership and to sustain the +PLUS+ network. The Council by-laws, approved at the June, 1989, meeting, defined the Council's purpose: "To promote teacher leadership in mathematics education, sustain the +PLUS+ network, further the objectives of +PLUS+ and establish regional satellite councils with eventual dissolution of the original Teachers' Council upon full implementation of satellite Teachers' Councils."

One teacher from each of 14 schools was designated as a Teachers' Council member at the beginning of the school year. At the Spring Conference in May, 1990, one teacher from each of the seven 1989 schools joined the Council to increase to 21 the represented schools on the Council.

The attendance at Teachers' Council monthly meetings averaged 19 teachers during the year. The range in attendance of teachers at a meeting was from 12 in November to 25 in

June, 1990. The teachers were joined by the +PLUS+ director, her program assistant, and the teacher coordinator. Sometimes other persons such as the district mathematics project director, Donna Jorgensen, would attend. Meetings were held from 4 to 6:30 or 7:00 p.m. at the LAEP office. The meetings began with an informal meal. Pre-meeting materials were distributed to be read while participants were eating. This generally was one sheet listing announcements, reports of recent committee meetings, and decisions that the Council had to make.

The format of the meetings was consistent during the year. The meeting began with approval of the minutes of the previous meeting. This was followed by a discussion of the pre-meeting reading material. Some time was spent on business that needed to be conducted and the meeting concluded with the project director's report. Although meetings had a structure, they were not so structured as to prevent friendly discussion. The meeting time was used for networking, continuing education, disseminating information, planning, making decisions, and conducting work such as reviewing and allocating funds for the continuation grants.

One major function of the Council was to allocate funds for continuation grants and for professional development grants. A specific amount of money was designated for each of these grants. The Council as a group made the decision as to who should receive a grant and how much the award should be. At the October 1989 meeting, a representative from each department applying for a continuation grant made a 10-minute presentation to the Council on what the department wanted to do with the continuation grant and how much funding was being requested. After each presentation, the Council took a vote on the amount to be granted the department and under what conditions. A lively discussion took place at the March 1990 meeting concerning who should be given travel grants to attend the NCTM annual meeting in Salt Lake City. The West Teachers' Council decided at its first meeting in February that the three teachers who had submitted applications by the established deadline should have their way paid. Members on the +PLUS+ Teachers' Council felt that rigid deadlines had not been adhered to in the past and that teachers who had not previously attended should be given priority. An underlying issue had to do with what structure was needed for making decisions that involved one satellite council and the +PLUS+ Teachers' Council. Finally, after some argument, the group decided to fund fully the expenses of a teacher who had not attended before and to award partial funding to the three teachers who had submitted their applications on time to meet the deadline. Two other teachers were designated as alternates.

Another major function of the Council is to raise professionalism issues and to educate the Council members about issues that pertain to leadership development. At the December meeting the group discussed the reactions they received from attendees (at the UMC annual meeting, held in Los Angeles), who visited +PLUS+ classrooms and were given the opportunity to observe teachers working with their students. Conference members had the expectation that they would be observing the "cream of the classroom crop," whereas the expectation of those from Los Angeles was that the visits were designed to visit regular classes that would stimulate later discussion at the conference. Rather, conference members were reticent to comment to the Los Angeles teachers and others about what they saw as less than exemplary teaching methods. Peripheral discussions were held, but no formal attention was given to the issue at the meeting. Afterwards, some of the attendees mentioned their concerns to Toby Bornstein, who then sent a letter to those who had attended the conference requesting their input about the experience and what they had observed that represented good teaching methods and what did not. The inability of members of the UMC to openly discuss teaching practices with each other was raised by Ms. Bornstein at the Teachers' Council meeting. At issue was the ability of teachers and others to learn how to give positive criticism and how to utilize that criticism as a means of improvement for professional growth. The director concluded the discussion, "We need to challenge--from challenge comes debate and from that comes better teaching."

The November Council meeting was devoted to hearing from representatives of the grant-writing group of the Los Angeles County Office of Education and a representative of the LAUSD grants office. At this session Council members were given some of the finer points in writing grants, such as walking the fine line between preparing a proposal to meet the applicant's needs while also acknowledging the interests of the granting agency. Council members were given a list of the sources of funds that are available to the mathematics departments that are collaborative participants.

The Council is the decision making body for the collaborative. Some of the Council's time is spent reviewing program alternatives or possibilities for approval and action. Not all of the work of the Council is handled at regular meetings. During 1989-90, five committees met as needed to oversee the planning and operations of specific events and issues during the year--Communications, Retreat, Professional Development/Continuation Grants, the Jaime Escalante Mathematics Teacher Award, and Equity /Leadership. Council members serve on these committees. One link among the committees is the Teacher Coordinator who serves on all of them. The committees report to the Council on the work of the committee. At the Spring Conference, four standing committees were established: Escalante Awards, +PLUS+ Workshops, Annual Conference, and Communication Committee (Newsletter and +TV).

**New +PLUS+ Departments**

In September, 1988, LAEP received a challenge grant from the Ford Foundation to address the issue of collaborative growth. One expectation was that the number of participating schools would be increased by 15 yearly over a three-year span. The grant was supported by funds from LAUSD to continue the program through June, 1991.

The process of identifying the mathematics departments to join +PLUS+ as the "Class of 1990" began in the fall of 1989. Flyers and application packets were sent to all schools that were not in +PLUS+. Mini-orientation meetings were requested by applicant schools on Tuesday, Wednesday, or Thursday between January 8 and January 31, 1990. In December, 1989, mathematics teachers from non-member schools were calling the +PLUS+ headquarters to get more information on membership. Director Toby Bornstein actively recruited several schools during January, 1990.

On February 24, 1990, Arco hosted the Department Planning Workshop Session I for the 1990 +PLUS+ schools. +PLUS+ planned the event (the first of two sessions), which was held at Arco Plaza. Nine collaborative teachers, the director, and 49 teachers from the joining schools, as well as a business representative and 3 facilitators attended. Participating schools included: Eagle Rock, El Camino, Gardena, and Marshall from LAUSD; Long Beach Millikan and Long Beach Polytechnic; and El Monte. Teachers were formed into working groups across departments and kept on task by a facilitator. Guidelines for proposal construction were provided to each participant to be used as a handy reference. Both breakfast and lunch were provided during the half day meeting.

The planning and program direction for new +PLUS+ schools has several facets: +PLUS+ department chairs and/or leads must first attend a meeting to identify site needs. Department members attend two half-day planning sessions to develop a plan for an improved mathematics program in their respective schools. Teachers earn $50 stipends for each session attended. A completed grant proposal for up to $2,500 to support the plan is submitted for preliminary review in May. Proposals are then returned to prospective departments with review panel recommendations. For the 1989-90 school year, the deadline for final proposals was set for June 7, with grant awards to be announced by July 1, 1990.

Grant awards are made and the implementation of plans begins in September, 1990. Districts support each +PLUS+ department, providing substitute days and professional or expert pay for out-of-school activities. A kick-off is event held in the fall to facilitate implementation and encourage the use of local resources and interaction with university and industry associates of +PLUS+. New departments meet monthly to discuss issues of concern and share successful strategies. A mathematics department can earn a $250 award for the most effective collaborative implementation and for other accomplishments.

Each +PLUS+ school receives a telephone line, modem, telecommunications software, and training to access the +PLUS+ TELEventure Network, which enables it to communicate with other +PLUS+ departments and to share resources. After the implementation year, each +PLUS+ department is represented on the +PLUS+ Teachers' Council which promotes leadership and sustains the +PLUS+ network.

At the conclusion of the first planning session, one teacher commented, "I am excited! I like the fact it's not funded by the district. Industry wants results." A second teacher added, "Well directed. We made a goal and don't want to lose sight of it. I liked the vision part of it. I also liked the fact that the facilitators were math teachers." A third teacher said, "Good way to get us started. I had some resistance at first because our department is doing a lot. We have gotten started and our wheel is rolling. Well organized." A fourth teacher contributed, "I got all the information I needed. I liked that: it started and stopped on time. I wasn't notified about how to get here--they need to look into their mailing. Facilitators helped lots; they were knowledgeable and kept us on task. I'm feeling overwhelmed." A fifth teacher remarked, "Everybody gets to talk with their department members was what I liked most. Now we have lots of work to do. But talking and more talking is a good place to start. I enjoyed myself."

One of the teacher facilitators said, "I was with a strong department. I wish I could transfer. It was fun to get them to focus on goals. The light bulbs were turned on." Dick Cone, +PLUS+ consultant, noted, "Noticeable difference from last year's planning session. Very little complaining. The facilitators were knowledgeable. A job well done." Another facilitator added, "First half bombed. The focus on goals helped--giving them a sample proposal helped organize them. I enjoyed my role and kept them on task." The on-site observer concluded, "Good planning session--the change from last year did help keep complaints down. The teacher facilitators were very impressive and the new schools thought so as well. Everyone was pleased to have time to talk and plan. Some were wondering how on earth they could finish this proposal on time. (They will.)"

+PLUS+ planned and the Northrop Corporation hosted the second Planning Session for the 1990 +PLUS+ schools. The group met on March 31, 1990, at Northrop for the second department grant-writing session. Seventy-two collaborative teachers, a coordinator, a representative from business/industry, and facilitator Judy Johnson attended; teachers received a $50 stipend for attending each planning session, or one salary point for attending the two planning sessions and the 1990 Fall Kickoff. Participants received a continental breakfast and lunch. The session began at 8 a.m. with Opening Comments, followed by A Process for Reviewing Proposals; Review of Proposals; Summary Session (what was learned during proposal review); Simulation of a Department Meeting; Departmental Review of School Proposals and Revisions; and Closing Comments and Announcements at noon.

One teacher remarked, "Good meeting--analyzing other schools' proposals really helped. Teachers should have given some positive comments with the negative ones. I enjoyed talking with math teachers from other schools." A second teacher added, "When I read other proposals I learned what needed to be in ours. More productive meeting than Planning Session I. Today we got something done. Last time it was more introduction; I want it to happen quicker." A third teacher said, "I enjoyed working in small groups and enjoyed the role playing. This helped me feel more supported. Facilitators were very helpful. I really enjoyed being here. This was well organized." A fourth teacher noted, "The way the proposals were spread out was great. I enjoyed the simulation of a department meeting. The feedback on our proposal was a terrific help. Well planned and nicely done." A fifth teacher added, "Today was really helpful getting/giving feedback. I enjoyed reading other people's proposals and the simulation. I liked how we came together as a department to discuss the helpful comments. It pushed us right along." Jean Elbron, a teacher from the collaborative in Columbus, Georgia, said: "I enjoyed the meeting. I was excited about everything. Well set up and timed. People were positive about the process. The skit (simulation) was a nice break in the meeting; it helped prepare them for the next part. . ." Teacher/Facilitator Harold Boger said: "My group did not take kindly to criticism. They were somewhat arrogant. However, they have come a long way and have focused. They have a good team lead and see her as a workhorse." Judy Johnson, +PLUS+ consultant, remarked: "I was so impressed with the teacher facilitators; they did such a good job keeping teachers focused. I wonder if the leadership training helped. I think it went very well, thanks to the facilitators." The on-site observer added, "This was the most successful meeting of its kind, I think, because of the experience of the teacher facilitators/+PLUS+ model. Also, the schools this round are of a higher quality. Teachers felt this was a day very well spent. They left, getting much closer to a well written proposal--the read-around models helped everyone grow."

The LAUSD high schools that completed a +PLUS+ proposal were: Banning, Eagle Rock, El Camino Real, Gardena, and Marshall. El Monte High School (El Monte Unified District) completed its planning proposal, as did Long Beach Polytechnic and Millikan High School, both in the Long Beach Unified School District.

On May 17, 1990, a committee of teachers and school administrators met and reviewed the proposals for goal focus, implementation, and evaluation. On June 7, 1990, a reception was held at the Senior High Division of LAUSD for prospective 1990 +PLUS+ departments. The new schools shared their plans for improving student achievement at their individual schools. Teachers and administrators from the new schools presented their +PLUS+ proposals. +PLUS+ staff, as well as facilitators (who assisted the new schools with their proposals) and the Office of Secondary Instruction personnel from all three districts, participated in the reception. Veteran +PLUS+ members from the 21 schools already active in the collaborative network were invited to attend.

## 1990 Department Action Plans

The department action plans developed by the new +PLUS+ departments all addressed problems relating to student achievement and teacher inservice.

The Banning High School departmental grant was mainly to provide a peer tutoring program for basic mathematics and Algebra I class and to develop a videotape of graduates from the school talking about the importance of mathematics. At Eagle Rock High School, teachers planned to offer tutoring to 7th- and 8th-grade at-risk students, to develop a bank of mathematics and computer materials and ideas, and to develop a consumer mathematics class for 11th- and 12th-grade students. At El Camino High School, the department planned a peer tutoring program for Algebra I, lunch time contests, and it made the decision to purchase software, calculators, and videos. Teachers at El Monte High School planned to provide a mathematics tutoring center, more hands-on learning activities for students, real-life situations for applying mathematics, and incentive awards to improve student attendance. The department at Gardena High School decided to offer tutoring and incentives to increase student motivation and skills, field trips, teacher inservices, and to work on improving parent involvement. The Long Beach Polytechnic High School departmental grant was to increase the use of technology by teachers and students, to have mathematics contests and fairs, to improve student placement in courses, and to provide teacher inservice. At Marshall High School the grant was used to encourage teachers to use manipulatives and technology, to develop a three-semester Algebra I course, to reward students for improvement in mathematics, and to provide teacher inservice. The teachers at Millikan High School planned to make greater use of manipulatives, cooperative learning, and innovative techniques, to create a mathematics resource center, and to provide students with incentives for doing homework, attending classes, and achieving in mathematics.

## 1989 Department Grants

Seven $2,500 +PLUS+ grants from LAEP and LAUSD were awarded on September 16, 1989, to schools in Los Angeles that had applied and that complied with the grant-writing application process. The Northrop Corporation hosted the awards event. These seven schools were added to the existing roster of +PLUS+ mathematics collaborative schools in

January, 1989. Recipients were selected by a grant review panel that included members of the Teachers' Council, using the school plan as the major criterion as well as the support of more than half of the mathematics department teachers.

A teacher at one recipient school commented, "We are delighted to have money to use for what we want." Another school added, "Thank God for +PLUS+." A third remarked, "It's a good start to move our department in the right direction."

The proposals for the grants were varied in focus. Cleveland High School proposed to integrate the use of calculators into all mathematics classrooms and to evaluate the plan to compare students' scores on pre- and posttests, as well as to compare them with the scores of students who did not have the calculator unit. Verdugo Hills High School implemented its grant in "Verdugo Dollars," an incentive program combined with the use of new teaching materials, strategies, and technology. North Hollywood High School sought increased collaboration to develop a standardized course, develop departmental examinations, identify student incentives, and utilize algebra software, in addition to promoting a spirit of cooperation among department members. Francis Polytechnic High School set a goal to develop a Mathematical Media Center as an ongoing project to keep the department working together, as well as to provide students with diverse learning opportunities. Special mathematics "open houses" during the school year, to aid parents in encouraging their children to improve their school work, were termed "commendable and unique" by Director Toby Bornstein. The desire to increase student commitment and motivation to succeed in mathematics via an incentive program and student recognition were specific goals of Roosevelt High School. A revitalized high school mathematics course featuring a life-based curriculum to increase student interest in mathematics was highlighted in the proposal from Monroe High School. Toby Bornstein identified the proposal from Hollywood High School as the most innovative of all those that had been received since +PLUS+ began in 1985. The support from the Hollywood High School administration and the business community for a double-period Algebra IAB class was an asset for their proposal. Ms. Bornstein commented further that, "The students will benefit from the extra time on-task, department collaboration, cooperative learning groups, use of manipulatives and technology, guest speakers, incentives, and peer tutors. The evaluation plan of comparing the experimental and control groups will hopefully validate the program and lead to its expansion."

Grants earned by each mathematics department were administered through trust accounts of the Student Body Funds at each school, according to instructions provided by LAEP. Problems in locating the funds in the district budget and then allocating these funds to teachers led the school financial services department to explore alternate ways of managing the grant. During November, 1989, the Budget Division could not identify all of the funds assigned to +PLUS+ within the accounting system. +PLUS+ Director Bornstein worked with the district staff to verify the assignment of funds to +PLUS+. In April, 1990, it became necessary for Director Toby Bornstein to contact Financial Services requesting that the awards for four of the schools be released so that teachers could be paid. Severe district budget cuts within LAUSD had forced a freeze on all expenditures, thereby trapping the implementation funds. With concerted effort, the funds were released.

The 1989 +PLUS+ departments were required to submit a final report to the Teachers' Council on their activities by June 30, 1989, to the Teachers' Council. All 1989 departments became eligible to apply for continuation grants for the 1990-91 school year.

**Continuation Grants**

Continuation grants were awarded at the Teachers' Council meeting on October 2, 1989. Funding was provided by +PLUS+ and Instructional Materials Account (IMA) district monies. +PLUS+ departments, from 1986 through 1988, were eligible to apply for the grants. In order to obtain additional grants from the Teachers' Council for school mathematics programs or professional development opportunities and to be eligible during an auxiliary period, departments had to submit annual plans to the Council. Requests for funds had to include a budget; those proposals that did not request funds from the Council but included funds from other sources also had to include a budget. The Teachers' Council determined the focus for grants in a given year and the grant pool varied each year, depending upon the availability of funds and the number of schools served by the Council.

Each continuing department was eligible for one auxiliary period each semester to provide time for the team lead(s) to fulfill obligations of Council membership and to assist with the implementation of school site plans. The use of the auxiliary period as it pertained to the department's plan had to be outlined in the school's plan/proposal.

In 1989-90, the grant pool had $6,000 in unrestricted +PLUS+ monies, $8,000 in IMA funding to match LAUSD, an undetermined amount of IMA funds to match funds from the Inglewood and El Monte districts, and $10,000 for attendance at professional conferences as well as 50 substitute days. The focus for the 1989-90 grants was an improved mathematics program that included one or more of the following components: strategies for assisting underachieving students; a parent involvement component; articulation with feeder schools; integration of mathematics and science; and the use of business and university associates. Criteria for the assignment of funds by the Council included: the value of the grant to the +PLUS+ network; measurable outcomes for teachers and students; involvement of the site administration; use of existing school resources; secured new funds to be matched by +PLUS+; and the creative use of auxiliary periods.

At the Teachers' Council meeting on October 2, one person from each school gave a brief overview of their proposal, followed by questions, and then a decision was made on a system for allocating grant amounts between +PLUS+ money and LAUSD/IMA money. Each proposal presentation was limited to ten minutes. Bell High School received $1,000; Belmont High School received $2,500; Crenshaw High School received $1,500 and two substitute days; Dorsey High School received $2,000; Fremont High School received $850; Huntington Park received $3,000 and 5 substitute days; Morningside High School received $400; Mountain View High School received $1,500; and Wilson High School received $1,400.

In the spring of 1990, the process of writing continuation grant applications began a new cycle, for the 1990-91 school year. +PLUS+ and Hughes Aircraft cosponsored a Grant Writing Workshop on May 19, 1990, from 8 a.m. to 1 p.m. at the Hughes Aircraft Headquarters. Fifty-one participants (48 collaborative teachers, the director, collaborative coordinator, and a business representative) enjoyed a continental breakfast and then turned to the development of departmental plans, followed by sharing and evaluating other proposals. At the conclusion of the evaluation period a buffet lunch was served. Educators received a $50 stipend, or five hours toward one salary point. Any +PLUS+ department that wanted to apply for a continuation grant was invited; fourteen schools were represented at the workshop. Teachers received materials for writing proposals and advice about the process. Joan Hairston, +PLUS+ teacher coordinator, said: "I was surprised at the good turnout. The teachers who came benefited from the information."

## EDC Outreach Grant

In response to EDC's request for proposals (RFP's) from the collaboratives for its 1989-90 Outreach Grant Program, +PLUS+ utilized several resources to develop its proposal. Initially, the +PLUS+ Teachers Council created a forum on +TV called "Outreach," which became an open invitation for teachers to share suggestions and ideas for appropriate proposal topics. (An outreach grant, if awarded, provided $10,000 for each selected collaborative to address one topic in research, networking, or policy initiatives.) Janet Daisley of EDC agreed to meet with a group of interested +PLUS+ teachers on January 2, 1990, to discuss the grant process in greater detail. The EDC timetable targeted January 31, 1990, as the RFP submission deadline, with funding to be awarded in March, 1990. Those projects that were granted awards had to be completed by December, 1990.

At the January 8, 1990 Teachers' Council meeting, Ms. Bornstein advised the members that she had hired Michael LePere from Huntington Park as a consultant to develop and write the proposal. After discussion and many council suggestions, it was decided that +PLUS+ would create a proposal to conduct a mathematics fair for all +PLUS+ schools, which would involve feeder schools and the use of TAP resources. Several teachers volunteered to serve on the proposal development committee and Donna Jorgensen of LAUSD agreed to act as a district advisor and resource person. On January 17, 1990, the Outreach Committee met with Michael LePere at the LAEP offices to learn more about the suggestions from Janet Daisley regarding the proposal. Her comments had been provided through a coast-to-coast conference call with committee members and Mr. LePere. Subsequently, modifications were incorporated into the proposal. The proposed mathematics fair competition was designed to emphasize the usefulness of mathematics in problem solving in the physical and social sciences. Preparation for the competition would require collaboration of the mathematics and science teachers with professionals from industry, participants from the HUMANITAS Project, and LAEP staff, as well as the training of mathematics and science teachers.

On February 27, 1990, the grant proposal was forwarded to EDC by Toby Bornstein and in March, 1990, EDC awarded $5,000 for implementation of the +PLUS+ grant proposal, with minor modifications.

## D. Project Activities

During the 1989-90 school year, the Los Angeles Urban Mathematics/Science/Technology Collaborative's +PLUS+ project sponsored and collaborated with other institutes to provide a variety of activities for member teachers in the greater Los Angeles area. Non-+PLUS+ teachers from nearby districts were invited to attend selected activities throughout the year when accommodations permitted their inclusion. The project also provided a variety of professional growth opportunities for teachers within the 21 +PLUS+ area. Non+PLUS+ teachers from nearby districts were invited to attend selected activities throughout the year when accommodations permitted their inclusion. The project also provided a variety of professional growth opportunities for teachers within the 21 +PLUS+ departments. Additionally, +PLUS+ gave support to participating departments for activities presented in the department's action plan.

### +PLUS+ Kick-Off

+PLUS+ began the 1989-90 school year with a Fall Kick-Off for members of the new 1989 +PLUS+ departments on September 16, 1989, from 8 a.m. to 1 p.m. at the Northrop Corporation's headquarters. The event, a joint activity of the collaborative and Northrop had three purposes: (1) to review the proposals of the new schools; (2) to share with other schools; and (3) to present $2,500 grants to the new +PLUS+ departments. Thirty-three collaborative teachers from seven of the eight new 1990 +PLUS+ departments, the collaborative director, a meeting facilitator, seven +PLUS+ teachers who served as facilitators, the collaborative coordinator, and the assistant coordinator attended. Each teacher attending received a $50 stipend. A continental breakfast and buffet lunch were served, arranged by Rogg Collins, Community Liaison at Northrop. Creative, eye-catching flyers and maps on how to get to the Kick-Off were distributed to publicize the activity.

Utilizing a problem-solution format, teams from individual collaborative schools identified problems and developed solutions for implementation. Examples of problem-solution sets are: poor attendance--establish incentive program; use of calculators--purchase calculators and develop calculator units; poor test scores--rewrite curriculum to match the state mathematics *Framework*.

One teacher commented, "I liked this meeting. I was impressed with the location and I didn't expect as many people from my department to show up. Now we can get communication going." A second teacher said, "I feel more open towards my department. Many good ideas came out today. We now have a common goal and can work towards it. We are coming to grips with improving our school." A third teacher remarked, "It was helpful hearing what other departments are going through. I picked up some valuable information for my classroom and department." A fourth teacher added, "I made contact with a resource person. Our department sat down and focused on our problems and made important decisions. The time together was worth every minute." A fifth teacher said, "The teacher participation was what I liked the most. The failure rate at our school is too high and today we attacked the problem and got help from others. We have a kinder gentler department. We are more open and receptive to other ideas." Director Toby Bornstein commented, "Each year it gets tougher to help the departments get what they need. We learn from our experience. If teachers could feel more comfortable with each other, more would be accomplished. Change takes place slowly." Facilitator Judy Johnson, said, "The tone in every group was wonderful. Groups worked well and everyone was working together." James Teal, Teacher Facilitator, added, "Meeting helped build camaraderie. Groups seemed secure in what they had done. They had a lot to cover." The on-site observer commented, "This meeting was a huge success. I visited every group and they were learning, sharing and working. They were delighted to receive their $2,500 checks. The environment was professional. Teachers felt good about themselves, their departments, and the teaching profession."

## +PLUS+ Workshop Series

For the fourth year, Professional Links with Urban Schools (+PLUS+) and the Office of Secondary Instruction in cooperation with El Monte Union High School District, Inglewood Unified School District, Los Angeles Unified School District, and Pasadena Unified School District, sponsored a series of four mathematics workshops held at Wilson High School. Teachers met on four Saturdays from 9 a.m. to 1 p.m., on October 28, December 9, 1989, January 20, and March 3, 1990.

Ten different topics were offered to high school and junior high school teachers; most of the workshops were appropriate for grades 7-12. Workshop I involved mathematics and science integration, so mathematics teachers were asked to invite a science partner from their own school. Among the ten topics offered in workshop formats were a number that addressed teacher-identified subject areas from the California Mathematics *Framework* and the NCTM *Standards*. Collaborating presenters came from teaching, research, and business; discussion focused on problem solving, which included interactive, hands-on formats, calculators and manipulatives, estimation and mental arithmetic, and mathematics software. Between each session, teachers were asked to fieldtest one idea from the previous session and to bring the results to the next workshop for discussion. Each teacher participant who attended all four workshops had the choice of receiving one salary point or a $150 stipend provided by the district. Other benefits for participants included fieldtested ideas to take back to their home departments, $200 for the best fieldtested idea from each workshop, applications and work simulations, problem-solving examples and strategies, evaluations of the newest materials and methods, and a teacher resource book. Over 100 teachers from 11 school districts participated in the workshop series.

## Workshop Planning Committee

The Workshop Planning Committee met on the afternoon of July 13, 1989, at the Senior High Schools Division office of the Los Angeles Unified School District. Lunch was provided prior to the meeting. Working from an agenda, the committee formalized workshop plans for the 1989-90 school year, setting dates, locations, and schedules. The roles of presenters and teacher coordinators were discussed and teachers attending the meeting were encouraged to serve in one of these two roles. Revisions were made on meeting evaluation forms and fieldtested idea outlines, and brochures and equipment needed for smooth workshop implementation were identified. The project director reviewed the mechanics of the workshop development grants for the 27 committee members who were present. The meeting provided the foundation necessary for the four-part workshop series.

## Workshop Informational Meeting

On October 12, 1989, 20 presenters and teacher coordinators met at Wilson High School from 4 to 6 p.m. with members of the Workshop Committee. Kathy Blackwood chaired the meeting. At what was designed as an informational meeting, teachers were updated on plans and arrangements, and roles and format were reviewed. The use of guest speakers and room selection for the workshops were addressed. Teacher Robin Gostin spoke on strategies for improving teacher participation. By the end of the meeting, all of the planning needed to begin the workshop series had been completed.

## October 28 Session

The first workshop in the series, held on October 28, 1989, was open to all mathematics teachers in Los Angeles County. Of the 106 who signed up for participation, 85 persons actually attended. Twenty-four were collaborative teachers, 49 were non-collaborative teachers, and one participant was a representative from business/industry. The session began with a pre-workshop demonstration by Michael Dacker on Fred Mail, which is a free telecommunications system that can be used by teachers and students. Eight workshops were offered: Depicting and Predicting for Quantitative Literacy, Alternative Algebra Approaches, Just Suppose, Software for the Mathematics Classroom, Geometry: Manipulative Mania, Turn on the Calculator and Turn on Your Students, Graphing Calculators, and Woodrow Wilson Mathematical Modeling.

Teachers were very enthusiastic about the workshop. One teacher commented, "I was excited seeing all these teachers out on a Saturday. My session went well and I learned about software we could be using at our school site." A second teacher said, "Great day. Great people, great session." A third teacher remarked, "I learned a lot today and the only thing I would change is to extend the time." A fourth teacher noted, "Everyone is so helpful; wish more people at my school were. I enjoyed talking math with fellow teachers." A fifth teacher said, "The day was interesting, stimulating, creative, worthwhile and fun. I'll be back next month." Debbie Novack, +PLUS+ project assistant, said, "It went very well. We were organized and the teachers had a good time." +PLUS+ Teacher Coordinator Kathy Blackwood, added, "This went much better than I expected. People were responsive and friendly. We are off to a good start." The on-site observer said, "It was a complete success. The day began with a group activity to warm things up. Then teachers went to their workshops . . ." At the conclusion of the workshop, teachers were given an opportunity to evaluate the workshop on a 1- to 4-point scale, with 4 the highest score. Scoring ranged from 2.77 to 3.89, with an overall median of 3.5.

### December 9 Session

The second program in the series was held on December 9, 1989, with approximately 80 teachers in attendance. All mathematics teachers, including non-+PLUS+ schools, were invited to attend. Don Delson, from the California Institute of Technology, presented a video and teaching materials developed by Project Mathematica for the Mechanical Universe Series, "The Story of Pi," as a pre-workshop demonstration. For this session, the average rating for individual workshops ranged from 3.36 to 3.86.

Thirteen respondents rated the workshop, Software for the Mathematics Classroom, with the highest rating, and one teacher commented, "The thing most liked about this workshop was: materials which I can use in my class because they came with worksheets." Several teachers commented that there was not enough time allowed for this workshop to cover topics such as fieldtested ideas and use of the computers. Another teacher, who commented on the Depicting and Predicting for Quantitative Literacy workshop, would have liked "Step-by-Step instructions written down. If I don't use this stuff regularly, I will forget it. It would be very helpful to have resources (better than my notes) to supplement what I do remember." At the Alternative Algebra workshop, one teacher commented that what was most appealing was "Refreshments, group sharing, and discovery of important parts of the learning process." At the Just Suppose workshop, one teacher commented on the thing least liked about that workshop, "Certain members of the group; I do not care for group work where I must interact with adults who are far from my own level of functioning." At the Turn on the Calculators workshop, one teacher expressed a desire for "more handouts." At the Graphing Calculator workshop, a teacher said it would be helpful to "View and compare all graphic calculators at one time so that we can decide which to purchase or use in (the) classroom." Several teachers who commented on the Woodrow Wilson Mathematical Modeling workshop said they liked the new ideas and applications.

## January 20 Session

The third workshop in the series was held on January 20, 1990. A total of 76 attended, including 20 collaborative teachers, the collaborative director and teacher coordinator, 50 non-collaborative teachers, 2 LAUSD school administrators, Les Leibovitch, District Mathematics Resource Teacher, and Kaz Ogawa, Senior High Schools Division Mathematics Advisor for the district. Although attendance at some workshop sessions was low, this had been anticipated since January has proven to be the month with the lowest overall attendance in previous workshop series. In evaluating the workshop, teachers awarded an average score of 3.69 on a 4.0 scale, with the average rating for the individual workshops ranging from 2.9 to 4.0.

## March 3 Session

The fourth and final +PLUS+ workshop for the 1989-90 school year was held on March 3, 1990. Fifteen collaborative teachers and 45 non-collaborative teachers attended this session.

One teacher commented, "I was pleased to have a chance to try new and different software. Things I would never have tried. New applications added to my growth as a teacher. They were great presenters. My computer experience has grown thanks to these workshops." A second teacher remarked, "Any time you have a thing like this it sparks you to do better. Presenters were excellent. I usually go to sleep, not in this workshop. I really appreciated the chance to try new things and receive encouragement and support from others in my workshop. It was great all four times." A third teacher noted, "I think the biggest part we enjoyed was the fact we were all junior high teachers. We had a chance to gain and share ideas. We got to see presentations, add to them, and try them in our classrooms. It was revitalizing." A fourth teacher said, "I think I found most exciting the fact teachers in the workshop had been teaching anywhere from 30-5 years. We learned new approaches. It says more about mathematics teachers than the public thinks. Young and old teachers are willing to learn new ideas." A fifth teacher commented, "I was impressed by the quality and dedication of these math teachers. I was delighted to work with other teachers--that excited me. I learned a lot and my students have benefited." Janet Miller, presenter for Graphing Calculators, said, "The participants made the workshop. Whenever you met new teachers it was a challenge to use the calculators appropriately. We were able to explore graphing calculators and refine techniques for using them in the classroom. This was a rewarding experience." Sue Olsen, presenter of Manipulative Mania, remarked, "Went well. It was nice because the group was enthusiastic. It was a change for me because in some workshops the teachers are quiet. Not this time; I learned from the sharing." The on-site observer remarked, "The participants went away feeling like they were part of something very important and feeling good that they tried new things in their classrooms. They were pleased to be a part of the series. Awards were given out at the luncheon. It was a fitting end to these workshops."

## +PLUS+ Workshop Evaluation Meeting

To determine ways for improving the workshop series, an evaluation meeting for workshop series coordinators and presenters was held on April 5, 1990, from 4 to 6 p.m. at the +PLUS+ office. Eight teachers, the collaborative director, the teacher coordinator and two guests met over dinner to evaluate the series. The recommendations made addressed continuation of the series, changes, extensions, and the selection of the best fieldtested ideas. A discussion was held regarding new topics needed, what caused the excellence of fieldtested ideas, how outside resources might be utilized more appropriately, how to address diverse backgrounds, and, ultimately, how to attract more teachers to the workshop series. Presenters and coordinators created a Teacher Resource Book, which contained the best fieldtested ideas for distribution, and made recommendations for the $200 grant awards for best fieldtested ideas.

In general, everyone agreed that the series was a success and needed only minor modifications. The presenters also shared their feelings regarding the experience of conducting a session. One presenter said, "I enjoy presenting and working with other teachers. I want to present--that's why I came to this meeting. From the workshop I assisted in, I took the materials and gave a workshop at my school. I get excited working with teachers. I want to work for students with teachers. I want to present at the next workshop series. It's a good thing." A second teacher commented, "I tried to integrate what I learned at MSTI (Mathematics Science Technology Institute) into +PLUS+ workshops. Also the week I went to Exeter I got to know people in my district--3,000 miles away. That's where Joan Hairston and I decided to do a workshop together. I couldn't do it alone, but we knew we could support each other." A third teacher remarked, "Seventeenth year (in) inner city junior high (and) moved to a high school. Guilt got me interested in joining +PLUS+. When I came to a workshop I enjoyed it. This is a way to make changes, change people's attitudes. That's the way it should be . . . . +PLUS+ was a valid use of my time. Last few years I've been focused on math. +PLUS+ workshops are the only way to go." A fourth teacher added, "I was leader of the calculator workshop last year. I was a presider of this workshop. I've grown. I feel more confident in working with other teachers and using the calculator. They were sitting in boxes, now we use them. Our school is learning to become more technologically advanced thanks to +PLUS+." A fifth teacher remarked, "We need to be more specific when selling these workshops. I felt like I had one teacher that didn't know what I was talking about. We should call and ask why people dropped out of the series. We had sharing of ideas. I always felt like we didn't have enough time. I think exchanging ideas is important. Now I look at calculators and go beyond computation. I'm breaking out of the mold." Director Toby Bornstein noted, "We got some good suggestions for next year. I want to have the workshops at California State in LA." The on-site observer concluded, "Excellent meeting with heartfelt suggestions for making next year's workshops even better. It is extremely important to evaluate and revise to make something better. I feel this was an important meeting that was successful in its mission."

### New +PLUS+ Schools' Department Site Meetings

Each month, one of the seven new 1989 +PLUS+ schools hosted a dinner meeting featuring a special activity of interest to mathematics teachers. All established +PLUS+ departments were encouraged to send representatives to each meeting to foster the integration of communication and networking among departments and to learn more about the mathematical focus within each new school. A representative from the host district administrative staff was present at the meetings to share pedagogical concerns with teachers and to answer questions that arose.

The first +PLUS+ Department Site Meeting was held at California State University-Northridge on October 16, 1989, from 4 to 6:30 p.m. California State provided a room in the faculty center and a buffet dinner for the meeting, which was hosted by Cleveland High School. The program offered an opportunity for teachers to learn about graphing calculators from their colleague Richard Curci. As a guest presenter, Mr. Curci brought Casio graphing calculators and suggested activities for the participants' use. All +PLUS+ teachers were invited; 10 collaborative teachers and 2 collaborative administrators, as well as 1 representative from higher education, attended the dinner meeting.

One teacher remarked, "I enjoyed the food and learning about the Casio calculator." A second teacher commented, "I've had a graphing calculator for three months and now feel like I can use one. Thank you." A third teacher said, "Time well spent; everything was well done. This was my first meeting and it won't be my last." A fourth teacher added, "I appreciated learning about the calculator from another teacher. Our department wants to buy a set for each of our department members." A fifth teacher noted, "This was great. I wish more people could have been here. These meetings are interesting. The group comes to our school next month; I hope it will be as good." Dr. Christine Smith, director of Teacher Education at California State, said, "We are pleased to be able to do this for high school teachers. I enjoyed having them." Kathy Blackwood, +PLUS+ teacher coordinator, said, "Everyone thoroughly enjoyed discovering the capabilities of this technology and it was hard to quit at 6:30."

The second Department Site Meeting was held at North Hollywood High on November 20, 1989, from 4 to 6 p.m. Dinner was served to the 24 who attended the meeting (20 teachers, 2 LAEP administrators, the NHH principal, and 1 guest). After dinner, Assistant Principal Neil Stone welcomed the participants and Dr. Richard Porter gave details of the mathematics and computer activities at North Hollywood High. The computer laboratory has 30 Apple IIC's and offers an introduction to computers and computer programming and honors courses, as well as information processing and advanced placement computer science. The new magnet program for gifted students at North Hollywood High offers a rigorous academic preparatory program. Dr. Porter also explained that mathematics teacher Jay Sevak runs a "Math Wizard" competition, publishing one mathematics problem a day in the daily bulletin.

Those who attended the California Mathematics Council (CMC) Conference gave a brief report; Jay Sevak had been a CMC speaker and brought hand-outs from his presentation, "The Art of Problem-Solving," to share with +PLUS+ teachers. Teachers who had been sponsored by +PLUS+ at the CMC meeting expressed their appreciation for the exciting and unique experience.

The +PLUS+ group then visited North Hollywood's instructional computer laboratory where Douglas Rightmer of Wilson High School gave an introduction to and exercises on the IBM *Mathematics Exploration Toolkit*. The lab currently has a networked system of 32 IBM PC Juniors. Mr. Rightmer presented interesting exercises on functions as mathematical models, demonstrating the way in which the *Toolkit* graphs the given functions.

One teacher commented, "I enjoyed the visit but wish we had more time using the IBM software instead of listening to what it could do. However, I found the meeting beneficial." Kathy Blackwood, +PLUS+ teacher coordinator, said, "It was a successful meeting. Doug (Rightmer) did a good job explaining the IBM software. We need to encourage all +PLUS+ schools to send a representative."

Monroe High School was the location for the monthly site meeting, held on January 22, 1990, from 4 to 6 p.m. Thirty-three attended the dinner meeting, including 29 collaborative teachers, the collaborative director and teacher coordinator, a school administrator, and Donna Jorgensen, LAUSD district representative. All teachers in 1989 +PLUS+ schools were invited to attend. After dinner, all ingredients necessary for making banana splits were made available on a dessert table. Teachers were invited to create their ice cream treats and the idea was enthusiastically endorsed by participants.

The agenda included a welcome, an overview of Monroe High School, an overview of the Monroe +PLUS+ proposal, and demonstrations by three teachers (Jenny Marple, Cesar Larriva, and Cindy Keysor). The program was titled: "Motivational Activities and Manipulatives" and included geopardy (geometry); bingo (Algebra I), and spatial relationships. Handouts included an agenda and roster, as well as a copy of "Assessment Alternatives in Mathematics," and the LACTMA flyer.

One teacher commented, "This was the best site meeting to date, because we were actively involved in doing mathematics activities we can use tomorrow." A second teacher said, "Great meeting. Lots of great ideas to use for our students. I'll use geopardy at our Math Fair." A third teacher remarked, "I feel great. I won a prize at bingo. I enjoyed this meeting; it was fun and informative. Monroe did a great job." A fourth teacher added, "Challenging spatial relationship activities; I will use them with my geometry students. The whole meeting was good and our group won geopardy." A fifth teacher contributed, "I picked up lots of good ideas to use in my classroom. This has been a good meeting; seems everyone had fun." Coordinator Kathy Blackwood said, "Meeting was great! This was the best site visit yet. We had fun and can use the materials in our classroom. Great ideas and everyone had a good time. The ice cream sundaes were delicious." The on-site observer remarked, "A good time was had by all. One of the best yet, because teachers were actively involved and learning."

The Roosevelt High School Department Site Meeting occurred on February 26, 1990, with 34 participants, including 27 teachers, 2 principals, 3 LAEP staff, the on-site observer, and Donna Jorgensen, Director of Staff Development for LAUSD, present. After a Mexican-feast dinner, Principal Henry Ronquillo presented a welcome and overview of Roosevelt High School. He said: "We are happy to be associated with LAEP. Twenty-four teachers are in the +PLUS+ program; they feel +PLUS+ is important. Any time a department gets together to look at strengths and weaknesses only good can come from it. The kids will benefit from the teachers working together." Mathematics teacher Robert Ochoa presented an overview of the Roosevelt Mathematics Department's plan, followed by a computer lab demonstration. LAEP staff member Debbie Novick demonstrated TELE-venture (+TV) training and Robert Ochoa spoke on a School-Wide Reward System. In addition to agenda and roster handouts, the school package contained a modem, software, an instruction book, connector cable, three copies of the participant's manual, and five reference cards for +PLUS+ TV.

One teacher said, "Glad to know how to use the modem. I also enjoyed the software we reviewed. Wish we weren't so rushed." A second teacher said, "I can't wait to send my first message on the modem. I enjoyed this session; the contest in the computer lab was fun--I won candy." A third teacher commented, "I see +TV as an important part of professional growth. It makes our mathematics community smaller and gets us information we need. Good meeting." Donna Jorgensen said, "It's good seeing teachers excited about learning new things. The turnout was impressive. I'm glad I came." The on-site observer said, "Good site-visit; lots of information on software (IBM and Apple). Everyone went away comfortable about getting on +TV. People were excited because they learned something new and networked with other teachers."

The Verdugo Hills High School campus was the location for the March 26, 1990, Department Site Meeting. The Verdugo Mountains provide a backdrop for the school's Spanish architecture. Twenty-one people including 19 teachers, 1 principal and the +PLUS+ project director, and the 2 speakers were served dinner. Then Alan Amundsen and Kathy Blackwood provided an intensive computer/software demonstration in the areas of geometry, Algebra I, and basic mathematics. The school has two computer laboratories with one room available for all classes to use. Director Toby Bornstein and Teacher Coordinator Kathy Blackwood closed the meeting with information about LAEP's Partnership Week and the 1990 Spring Conference.

Hollywood High School was the location for the +PLUS+ Department Site Meeting on April 23, 1990, from 4 to 6 p.m. Thirty-one people, including 25 teachers, 4 collaborative staff, and 2 students, attended the dinner and heard Principal Karleen Marienthal give the welcome and overview of Hollywood High School. Geoff Buck presented an overview of the Hollywood Mathematics Department's plan and reported on his attendance at the NCTM Conference in Salt Lake City. After general announcements and discussions, Ellen Greenman demonstrated "The Magic Circle," a geometric manipulative focusing on the measurement of diameter and radius. Maddy Golob led a discussion on the implementation of double-period algebra classes. Two students gave a presentation to the teachers about the impact the class has had on them and told about their interest in continuing to learn more about mathematics.

The final Department Site Meeting for the 1989-90 school year was held at Francis Polytechnic High School on May 21, 1990, from 4 to 6 p.m. Twenty-five participants, including 19 collaborative teachers from 8 schools, the collaborative director and teacher coordinator, 2 school administrators, and 2 district representatives--Les Winters and Donna Jorgensen--attended the meeting. Classroom materials and dinner were provided for those in attendance. Guests received raffle tickets and mathematics puzzles on arrival. After dinner, posters, books, and book bags were given as prizes.

Teacher Virginia Holt provided the welcome and the overview of Francis Polytechnic, and Ben Gattegno gave an overview of the Mathematics Department's plan. Computer Applications for Algebra 2 were presented by Steve Ward and Geometric Manipulatives by John Ford. Mr. Ward demonstrated how he uses low volume new age music, computer graphics including fractals, and graphing software in his classroom to motivate students. A highlight of the meeting was the award of prizes collected from mathematics conferences by their department head. One teacher said, "It was a great meeting and Poly gave out prizes that their department head collected from mathematics conferences." Kathy Blackwood commented, "Everyone enjoyed their presentation and the prizes were a great idea."

At the conclusion of the meeting, Monroe High School was selected by the team leads as being hosts of the best meeting. Monroe High School members were presented with a $250 Implementation Award at the end of the meeting.

## Classroom Demonstrations

A series of classroom demonstrations was held during the 1989-90 school year at eight +PLUS+ schools. The series, coordinated by Kathy Blackwood, was designed to allow teachers an opportunity to observe host teachers in the utilization of a variety of mathematics teaching strategies within the classroom. Volunteer host teachers made themselves available for an hour after the lesson to discuss what occurred in the classroom. LAUSD teachers who observed a classroom demonstration were provided substitute coverage and mileage reimbursement. Each site demonstration was limited to ten teacher observers. Teachers who wished to attend a classroom demonstration lesson had to register in advance through the +PLUS+ office. Notices confirming registration were sent to visiting teachers. Between October, 1989, and May, 1990, series topics included: algebra manipulatives, the *Geometric Supposer* computer software, word problems, English as a second language, mathematics, peer tutors, "build-a-book" geometry, cooperative learning, and pre-calculus.

Teachers who attended teacher Chip Healy's "build-a-book" demonstration learned that students were discovering and inventing geometry and that many of the student-defined terms were unfamiliar to the observers. The demonstration required explanations from students regarding terms and concepts, thus making the demonstration a two-way learning experience.

Teacher Robin Gostin's cooperative learning demonstration at Fairfax High School focused on students working to define and explore parts of a circle. The students were diligent in their quest and exhibited an apparent comprehension of their discoveries. Teacher observers were surprised to learn that the students had been identified as underachievers and were in a special program referred to as College Capable Curriculum (CCC). Fairfax High School has been mainstreaming deaf and hearing-impaired students, so the lesson was presented to those students in sign language by Ms. Gostin. Students who have no hearing impairment work well in small groups with the hearing-impaired in a cooperative learning environment.

At the February, 1990, Teachers' Council Meeting a discussion was held on how to better promote attendance at demonstration lessons. A decision was made to eliminate the September, January, and February demonstrations due to heavy school calendar demands in those months. It was suggested that a topical survey be conducted among the teachers to discern preferences in observation.

### Jaime Escalante Awards

The second annual Jaime Escalante Mathematics Teacher Awards were sponsored by the +PLUS+ program under a grant from the Arco Foundation. Developed by the +PLUS+ Teachers' Council, the awards program seeks to reward teachers who have motivated students with a desire to achieve in mathematics. The awards are named for Jaime Escalante, a Garfield High School mathematics teacher who expects students to excel beyond expectations. To qualify, teachers must currently teach secondary mathematics at least half-time in Los Angeles County public schools and demonstrate an exceptional ability to motivate students toward mathematical success. Current and former students in the Los Angeles County public schools may nominate a teacher of their choice by writing an essay; administrators, parents, teachers, and community members may also nominate a teacher if supporting student essays are included.

The competition was announced in October, 1989, with December 10, 1989, announced as the cutoff date for nominations. A selection committee of students, teachers, representatives from LAUSD, UCLA, and LAEP, met on January 25, 1990, and narrowed the field of candidates to 10 from a total of 86 nominations for 33 teachers. All ten candidates were interviewed by three different panels on February 15, 1990, to determine which three teachers would receive $1,000 awards--the remaining seven would receive $500 awards. One +PLUS+ school teacher, Kamal Hamdan of Washington Preparatory High School, was named a finalist. On March 8, 1990, an elaborate reception was sponsored by Arco at corporate headquarters. Linda Alvarez, KNBC news anchor, emceed the program and Jaime Escalante participated in the awards presentation. One finalist, Robert Morris of Lynwood High School, commented: ". . . I have to tell you how much I am honored by all of this. Mr. Escalante is the MASTER and the rest of us his disciples. His belief in his students and their success serves as a constant source of inspiration to me and my students. . . . I wonder if he realizes just how far his influence extends beyond the fences at Garfield High?"

The decline in the number of nominations during the second year of the Awards was discussed at a subsequent Teachers' Council meeting. Some Council members noted that building principals did not make posters and related information available within their schools on a timely basis. The Council decided that in the future press releases would be sent out and building principals would be notified earlier to allow sufficient lead time for the nomination process.

### The Second Annual +PLUS+ Spring Conference

On October 23, 1989, the three members of the Spring Conference Planning Committee met to finalize the Spring Conference schedule for May 4-5, 1990, and to make planning arrangements. The meeting agenda included prioritizing topics for forum discussions, listing contributions to the +PLUS+ network, and developing a list of needs for the network. A Team Lead Questionnaire was distributed at the meeting to help the committee meet the needs of the Friday conference session for team leads and department chairs. The questionnaire addressed appropriate luncheon themes, speakers, and afternoon discussions, interest in a wine and cheese reception, an IMAX Theater show, and other suggestions from leaders and chairmen.

The three-member teacher committee met again on January 23, 1990, to finalize the Spring Conference schedule. Between March 26 and April 15, 1990, departments were encouraged to hold dinner meetings at individual locations to discuss the Team Lead Questionnaire. The Teachers' Council allocated $10 per person for dinner within each +PLUS+ mathematics department, and in return expected to receive a completed questionnaire indicating the department's selection of topics for forum discussion at the conference. At the department dinner meetings, another teacher or staff person was present to facilitate the meeting.

The Annual Spring Conference was held in the Museum of Science and Industry. On Friday, May 4, 42 participants, including 39 collaborative teachers, the collaborative director and teacher coordinator, and coordinator assistant attended. Twenty schools were represented, as well as LAEP and the university community, during the two days. All three districts provided substitute coverage for teachers who attended.

The program on Friday included School Reports, an Overview of the Conference, Committee Meetings, Teachers' Council Meeting, a reception, an IMAX theater presentation ("To the Limit") and dinner at Margarita Jones restaurant as an advance celebration of Cinco de Mayo. Committees met from 10 a.m. to noon and addressed the following topics: by-laws, professional development, continuation grants, leadership and communication, next year's budget, and the structure for a satellite Teachers' Council.

Saturday's agenda included breakfast keynote speaker Henry Gradillas, former principal of Garfield High School (Jaime Escalante's school), Forum Sessions, Department Meetings, and Implementation Awards. Mr. Gradillas advocates improved mathematics education for all students, thereby endorsing the NCTM *Standards*. Eighty-five (80 teachers, the collaborative director and coordinator, 1 representative from higher education, and 2 others) educators participated in the day's events. Forum Session I met from 9:30 to 10:45 a.m. and included the following topics: equity, parent involvement, financial resources, curriculum and assessment, student motivation, and technology.

Forum Session II met from 11 a.m. to 12:15 p.m. and included: political empowerment, community resources, financial resources, curriculum and assessment, student motivation, and technology. Teachers selected one forum to attend at each session. Implementation awards of $250 were given on Saturday to continuing departments and implementing departments. Among continuing departments, Mountain View received three awards, Huntington Park two, and Belmont and Bell one each. Awards for implementing departments included two each for Monroe, Roosevelt, and Verdugo Hills, and one for Francis Polytechnic.

Reactions to the two-day conference were mixed. One teacher remarked, "At Friday's Committee Meeting someone in every group was not interested in the meeting because they have not been involved with +PLUS+. A second teacher said, "Highlight of Friday was the satellite we got to see being built, the IMAX Presentation, and Margarita Jones. On Saturday, Henry Gradillas gave us an inspiring speech." A third teacher added, "Basically I feel it was non-productive. The new teachers to +PLUS+ didn't know what was going on and they needed more information. There were a few bright spots like IMAX." A fourth teacher noted, "They talked too much on the by-laws report." A fifth teacher said, "I found one forum session good and another boring. The time we spent with our department in the afternoon was valuable." Another teacher remarked, "This is the best conference I have ever attended!" Toby Bornstein said, "It was a good two days." The on-site observer said, "Seems like Friday did not go as well as Saturday. Teachers who are active in +PLUS+ felt new teachers needed more of an explanation. The Teachers' Council Meeting, I feel, could have been better but they ran out of time."

### Woodrow Wilson Fellowship Institute and Follow-Up Workshop

For the second year, +PLUS+ was able to bring an outstanding mathematics institute to Los Angeles, sponsored by the Woodrow Wilson Fellowship Foundation. The Institute on Mathematical Modeling was held from July 31 to August 4, 1989, in the LAUSD Professional Development Center (Osage). Registration, which was limited to 30 teachers who were assured of a teaching position for the 1989-90 school year, was on a first-come, first-serve basis. The Institute fee of $125 was waived for the 11 +PLUS+ teachers who attended. Twenty additional participants from LAUSD and LA County Schools also attended.

The fee covered lunch and coffee breaks from Monday through Friday, a dinner on Thursday evening, and all curricular materials. LAUSD offered salary points and some universities offered credit upon completion of the course, contingent upon verification from +PLUS+.

The week-long Institute was part of the "Teachers Teaching Teachers" Program in which some of the best mathematics teachers nationwide were trained at Princeton University to conduct one-week institutes at selected sites. Conducting teachers for the Modeling Institute were: Gloria Barrett, North Carolina School of Science and Mathematics; Allan Bellman, JFK High, Silver Springs, Maryland; and David Daniels, Longmeadow High, Longmeadow, Massachusetts.

The primary focus of the Institute is using mathematics to describe real-world events and to solve actual problems. Examples were drawn from science, economics, sports, management, engineering, and the social sciences. The content was designed to enhance the mainstream secondary school curriculum, from arithmetic and algebra through pre-calculus. Methods used included graphs, tables, formulas, functions, and simulations. When their use was appropriate, scientific calculators or computers were used as modeling tools, but computer programming skills were not required of participants.

One objective of the workshop was that participants would return to their classrooms with an appreciation and understanding of the role of applied mathematics in the real world. A sourcebook of suitable materials for secondary mathematics classes was provided and used throughout the week. Examples presented during the Institute varied in complexity and depth; several were classified as open-ended problem-solving activities.

Informal opportunities were provided for all teachers to exchange information on mathematical content, pedagogical techniques, and classroom management methods. The overall goal of the Institute was to demonstrate how modeling can become a comfortable part of each teacher participant's curriculum domain, thereby increasing the teacher's levels of interest, effectiveness, and currency.

Teachers commented on their week-long participation: One remarked, "[we were] introduced to good materials by very competent teachers in a quality way." A second teacher noted, "My expectations were greatly exceeded. Presentations were far more dynamic than I expected and the material was much less esoteric than I thought it would be." Another teacher said, "This was the most professional workshop I have ever attended. The materials that were presented were created in the classroom." A fourth teacher concluded, ". . . I was very impressed with the level of teaching and the quality of teachers." As an outcome of the week, teacher Stephanie Smith of Glendale Unified School District presented the materials covered in a +PLUS+ fall 1989 workshop.

## March Follow-Up Workshop

Five +PLUS+ summer participants reconvened for a follow-up session on March 24, 1990, at Venice High School. Alan Bellman, a master teacher from Silver Springs, Maryland, led the group discussion. In addition to sharing lessons tried during the year, teachers discussed the reform movement in mathematics education, including curriculum, teaching techniques, and means of assessment. A new topic, fractals, was introduced. The teachers also viewed a video lecture presented by Jonathan Choate of the Groton School.

## IISME (Industry Initiatives in Science and Mathematics Education)

LAEP's Industry Initiatives for Science and Mathematics Education (IISME) announced open recruitment for teachers in the fields of research and industry in March, 1990. Secondary mathematics, physics, and computer science teachers from LAUSD schools were eligible for six-week summer positions, which pay between $500 and $700 a week for the six-week period. Teachers who had taught three periods or more of science, mathematics, and/or computer science for the past three years, held a BA or BS degree with a major in a field of mathematics or science, or had equivalent experience, and had completed requirements for a secondary teaching credential in mathematics or science were eligible to apply. Teachers could obtain applications from department chairs, from LAEP program representatives, or by phoning the LAEP office. The submission deadline was March 30, 1990. Selected teachers work on company or university projects including computer programming, laboratory research, and statistical analysis. The experience allows teachers, on returning to their classrooms, to create on the basis of their summer experience applications relevant to their teaching by developing a curriculum project. In addition to gaining new ideas for their classrooms, the teachers learn more about outside organizations and consequently are able to develop new professional relationships. Available possibilities for the summer of 1990 include work at corporations, utilities, universities, and hospitals in the Greater Los Angeles area, with several positions located in Orange County. The Northrop aircraft facility in Hawthorne had two available positions and Rockwell had three positions available at Downey, the space shuttle facility, as well as a fourth at Lancaster in processing control.

IISME Fellow guidelines detail the responsibilities of teachers selected for the program: (1) develop a curriculum project to enhance current teaching strategies to be disseminated to other teachers in the Fellow's home department; (2) carry out responsibilities as articulated by the mentor; (3) actively seek out opportunities to do research in the IISME work environment; (4) prepare an evaluation of IISME as requested by the employer and IISME staff; (5) agree not to accept employment with the IISME sponsor for the following two years.

During the summer of 1990, teacher James Herrmann became the first Rockwell Fellow under the IISME program at Downey. Barry Murray LaSala of Roosevelt High School, a +PLUS+ school, worked for eight weeks during the summer in the LA Department of Water and Power (DWP) laboratories. LaSala and three other teachers from area schools were IISME Fellows. DWP Chief Chemist Tim Hemming, a mentor for three of the teachers, said, "Having the teachers here was a learning experience for our employees. The teacher fellows asked intelligent questions of our staff. This sharpened our employees because when you answer technical questions, you really review the fundamentals yourself. The teachers performed excellent work for us enthusiastically." LaSala said, "There really is a lot I can take back to the classroom. I can use examples of what I did in the lab to expand on what we discuss from the books. And there are so many educational resources from the DWP that I can use in my curriculum."

### Teacher Associate Pairs (TAP) Program

The TAP program was initiated during the 1986-87 school year to foster interaction between high school mathematics teachers and mathematics professionals in the workplace. As an experimental program initially, Hughes Aircraft retirees were paired with +PLUS+ teachers in order to identify appropriate topics and effective formats of interaction between teachers and practicing mathematicians that had "real world" applicability. Initially, retirees and teachers had frequent telephone contact and subsequently a "buddy" network evolved. Additional active and retired Hughes employees volunteered for the program and a strong link was forged in the school-industry network.

One of the goals of the +PLUS+ program is to establish a network of TAP associates accessible to all +PLUS+ teachers, with a minimum of 100 teacher participants by 1991. One development in the TAP program is the creation of a common data base which matches participants on the basis of mathematics topics, applications, and forms of interaction. The computer network holds the promise of making mathematics a vital activity in the classroom and contributes significantly to the growing knowledge of +PLUS+ teachers.

Teachers may develop leadership skills in the TAP program by interviewing potential associates, introducing and using technology for information management, disseminating information through TELE-Venture, developing mathematics topics/new units with associates, and collaborating with business and university associates. In November, 1989, Director Toby Bornstein advised the Teachers' Council that the formation of a TAP Committee would be desirable as a means of determining how teachers and industry representatives could interact most advantageously. Council members were encouraged to recruit mathematics department members and to submit names of potential members to the Council. At the January 1990 Council meeting, it was suggested that TAP associates and resources be included in the plans for a grant to fund a district-wide mathematics fair. The TAP Committee, however, was never convened.

In an effort to form a stronger relationship with one institution of higher education, the California Mathematics Project at California State University at Los Angeles, under the direction of Dr. Grant Fraser, was approached to co-sponsor the +PLUS+ workshops. After meetings in May, 1990, an agreement was reached. The Teachers' Council will still make decisions regarding the workshops. The workshops will be held at California State-Los Angeles. In this way, professors from that institution will observe the workshops.

**TELE-Venture**

The telecommunication system, a program of the LAUM/S/TC, offers teachers an opportunity to exchange information as well as to participate in forums on critical issues affecting mathematics teachers. In addition to teachers in the 21 +PLUS+ departments, several science teachers and district instructional specialists use the network.

The +PLUS+ Communications Committee met on July 17 at the LAEP offices with five teachers present. The development of a data base for the +PLUS+ library was the subject of the meeting. Director Toby Bornstein noted the three-fold purpose of the library: (1) to organize +PLUS+ materials into a data base which teachers could use to retrieve materials according to specific criteria; (2) to access the data base via +PLUS+ TELEventure (+TV); and (3) to develop a mechanism through which teachers' evaluations of materials can be referenced via the database and +TV. Use and programming requirements centered on access to the data base via Common Ground. In addition to setting up the data base, training and assistance for +PLUS+ teachers on its use would be provided. A target date for full implementation of the new access program was set for the end of 1989. One teacher remarked, "The data base is going to be hard to set up--we are still working on it."

The +PLUS+ Communication Committee met again on October 25, 1989, with three teachers attending the meeting. At that time, +TV was still not on-line at Bell, Fremont, Manual, and University high schools. The problem had not been identified. A "no instruction" contest that would begin before November 6 to encourage +TV usage was announced. Prizes were selected from Creative Publications, Dale Seymour, and other catalogs. It was billed as a "discovery" activity.

Team leads were encouraged to use auxiliary personnel to log on daily, send messages to department members, and announce meetings. Plans for adding a calendar forum with dates of upcoming events were announced.

Six teachers from the +PLUS Communication Committee met on January 16, 1990, to discuss issues related to +TV. Only two prizes of 20 available had been claimed in the +TV contest begun in November on +TV's Awards Forum. The Committee decided to try to reach a broader audience, which involved advertising in the +PLUS+ newsletter, on

+TV, and via an item on the next Teachers' Council agenda. Team leaders were requested to ask users, "Why do you use +TV?" and send the results to the +PLUS+ newsletter.

Beginning June 1, 1990, +TV became the main means of communication between teachers and the +PLUS+ administrative staff because no administrative support was provided.

### Collaborative Newsletter

The collaborative initiated the publication of a monthly collaborative newsletter, *NON +PLUS+ ED*, in April, 1989. Designed to keep collaborative members informed and involved, the newsletter is distributed to all +PLUS+ teachers and district staff, and the entire UMC network. +PLUS+ members are encouraged to contribute to the newsletter by sending information or suggestions through TELE-Venture, in writing, or by telephoning the editorial staff directly. During the 1989-90 school year, the +PLUS+ Communications Committee monitored the growth and progress of the newsletter. Teachers Kathy Blackwood and Joan Hairston served as the editorial staff with assistance from collaborative Administrative Assistant Marlene Mercado-Rios.

In August, 1989, a +PLUS+ Logo Contest was announced in the newsletter. The design was to be used on a T-shirt. Contest rules encouraged individuals or departments to come up with the best design to be selected by the Teachers' Council. The winner won free T-shirts for his or her entire department and the rest of the network could receive them at cost. At the December Teachers' Council meeting, a design created by teacher Michong Gilbert of Huntington Park was selected as the winning entry. The logo stated: "Math is a chain of infinite possibilities." Shirts were available for purchase at the Spring Conference.

The newsletter was published ten times between August, 1989, and June, 1990; there was no issue during January, 1990.

## Grants

### LAEP Workshop Fair and Conference

The LAEP grants program provides direct cash grants to teachers who, according to LAEP criteria, display the creativity and dedication that can make a difference in education. The grants reward classroom innovation and provide teachers with development funds and access to resources not otherwise available. The unique classroom ideas generated by these teachers are disseminated throughout the Los Angeles Unified School District via an annual Workshop Fair and the LAEP Catalog. The 1989-90 Workshop Fair and Conference, at which teachers present their award-winning projects, was held at the University of Southern California June 26-27, 1990. These activities improve teacher morale, encourage inventiveness in the classroom, promote professional development, and facilitate communication among teachers. Making the grants directly to teachers also demonstrates that the community trusts, respects, and wants to provide tangible support for individual educators.

### LAEP Small Grants Program

Over the past six years, Small Grants for Teachers has awarded nearly $750,000 to over 2,000 teachers in 474 schools throughout Los Angeles. Elementary teachers may apply individually (for up to $400) or in teams (for up to $800), and secondary teachers must apply for team grants representing two or more disciplines. The team emphasis is designed to encourage interdisciplinary and collaborative teaching while addressing the problem of teacher isolation.

During 1989-90, $100,000 was awarded to 294 teachers to carry out 153 creative classroom grant projects. Teachers Bruce Wagner and Herbert Henry of Bell High School (a +PLUS+ school), for example, were awarded a small grant to develop a course component in fractal geometry. Their proposal combined lectures and laboratories for students that recognize how elementary concepts in mathematics and science can be expanded.

Major support for Small Grants for Teachers was provided by the Arco Foundation, Avery, BankAmerica Foundation, Conrad N. Hilton Foundation, Great Western Financial Corporation, IBM, J. B. & Emily Van Nuys Charities, Joseph Drown Foundation, Leavey Foundation, Litton Industries, MCA Foundation, Neutrogena Corporation, Parsons Corporation, Robinson Foundation, Roth Family Foundation, Security Pacific Foundation, Sidney Stern Memorial Trust, the Prudential Insurance Company, Toyota USA Foundation, and Union Bank Foundation.

Mathematics, science, and technology grants were provided by GTE California, Hughes Aircraft, Lockheed Corporation, McDonnell Douglas, Northrop Corporation, Rockwell International, and TRW Foundation.

## Professional Development Grants

+PLUS+ offers professional development opportunities for teachers to attend local, regional, and national conferences. During the 1989-90 school year, a total of $10,000 was awarded to 47 teachers. Six teachers were given grants to attend the California Mathematics Council Annual Conference. Ten were awarded grants to attend the NCTM Annual Meeting in Salt Lake City. Eight were given grants to attend the fifth annual Phillips Exeter Conference. Twenty-three were given grants to attend the August, 1989, Woodrow Wilson Institute. School districts provide substitute coverage for teachers when necessary. Selection is made on the basis of the contribution the information obtained will make to the individual's professional development. The information received through these opportunities is disseminated at department meetings, workshops, classroom demonstrations, and other similar settings.

During the 1989-90 school year, +PLUS+ offered grants for attendance at California Mathematics Council sectional meetings in Long Beach and the LACTMA meeting in Los Angeles in March, the NCTM Annual Meeting in Salt Lake City, Utah, and the regional meeting in Honolulu. Grants were also awarded to enable teachers to attend the Technology in the Classroom Conference at Exeter, New Hampshire, and the Woodrow Wilson Institute, both held during the summer of 1990. Individuals may also apply to the +PLUS+ Teachers' Council for up to $200 in matching grants for assistance to attend these and other conferences. Teachers are particularly encouraged to apply for Woodrow Wilson

Institutes, California Mathematics Project conferences, NSF grants, and National Endowment for the Humanities grants.

## Citicorp Mathematics/Science Collaboration Grants

The Citicorp Mathematics/Science Collaboration Grants Program, administered by LAEP, is designed to promote the development of new approaches to the study of mathematics and science through collaboration and interdisciplinary teaching. Six grants of up to $2,500 were available during 1989-90 for collaborating teams of four or more teachers from +PLUS+ and Target Science secondary schools only. The grant proposals are judged by a panel of educators, mathematicians, scientists, and Citicorp employees. Awards were presented in January for spring implementation. Three teams from the LAUSD were each given a grant of $2,500. One grant was awarded to a team of four teachers from Roosevelt High School who planned to have students use correlation statistics to study the effects of trees on urban microclimates. Two teams from Bret Harte Preparatory Intermediate School received grants: One encouraged students to address ways of reducing pollution by graphing and charting smog and waste levels in Los Angeles and other cities. A second enabled students to study waves and the particle nature of light, using calculators and exponential notation for calculating the speed of light.

## Best Field-Tested Idea (FTI) Grants

The best field-tested ideas from the 1989-90 +PLUS+ Workshop Series were selected in June, 1990, and announced in the collaborative newsletter. Winners were awarded $200 professional development grants and had their lessons published in the 1989-90 Best FTI Book. All workshop participants and +PLUS+ departments received copies of the book. Winners were: Harvey Revzner, Inglewood High School; Susan Amelang, Pacoima Junior High School; Frank Ramirez and James Herrman, Belmont High School; Marty Solig, University High School; Joe Henderson, Long Beach Wilson High School; Leticia Burch, Frost Junior High School; and David Harris of Burbank High School.

## National and Regional Conference

### California Mathematics Council (CMC)

The Southern Section of CMC held its annual conference in Long Beach, November 17-18, 1989. +PLUS+ was represented by presenters Toby Bornstein, Margaret Shoukry, and Warren Zarrell and presiders Kathy Blackwood, Lorrie Freedman, Ellen Greenman, Yvonne Russell, Tom Walters, and Barbara Wills. College credit was made available through California State University-Long Beach.

One teacher who attended remarked, ". . . most workshops and sessions seemed to revolve around the use of calculators and manipulatives. I was happy to be able to present the guest speakers from the State Department of Education on the CAP test. . . . The emphasis on Open-Ended questions appears to be Problem Solving and Critical Thinking. Yeah for +PLUS+, we're already on the right track. I'm looking forward to the next conference."

CMC also offered professional inservice grants for credentialed members of CMC-SS and professional scholarships for the retraining of members in mathematics. The qualifications for receiving a grant were established via the application process.

### National Council of Teachers of Mathematics (NCTM) Annual Meeting

Educators representing the fifty states, Japan, and Canada assembled April 18-21, 1990, at Salt Lake City, Utah, for the NCTM Annual Meeting. Thirteen +PLUS+ teachers and Director Toby Bornstein attended the meeting. Only three of the attendees were fully funded by +PLUS+.

The conference presented opportunities to attend talks and workshops, to meet people who are doing mathematics education research, and to evaluate the latest mathematics textbooks as well as hardware and software in the exhibit displays. According to one teacher, "The most overheard buzzwords were T1-81 (user-friendly graphing calculator), the *Standards*, teacher empowerment, applied math, integrated curriculum, and symbolic manipulators."

One conference feature was an evening UMC session with Manuel Fernandez. This presentation highlighted the relation between teacher expectations and student development. Mr. Fernandez has developed his program to combat student underachievement in Boston, Massachusetts. Another conference highlight was speaker Lola May of Winnetka, Illinois, who spoke of NCTM's new vision and the new challenges facing educators.

After the meeting, members of the +PLUS+ contingency commented that they had gained new enthusiasm for the profession. Some said they experienced a reaffirmation of their conviction to improve mathematics education. Many felt "regenerated." All teachers acknowledged the value of the comradeship developed during the conference.

## Phillips Exeter Academy Conference

Seven teachers from 1989 +PLUS+ schools attended the 6th Annual Conference on Secondary School Mathematics and Computers at Phillips Exeter Academy in New Hampshire, June 24-29, 1990. In the past, participants have developed workshops from materials and information acquired at the conference. The conference explored the mathematics curriculum of today and tomorrow with special focus on the impact and applications of technology in the classroom. Solomon Garfunkel, executive director of the Consortium for Mathematics and Its Applications, was the keynote speaker. Other featured speakers were Thomas Brieske of Georgia State University, Atlanta; Richard Brown, Phillips Exeter Academy; and Helen Compton, North Carolina School of Science and Mathematics, Durham. The primary focus of the conference was on two seminar courses led by experienced classroom teachers. Each seminar, which was limited to 14 people, met for two hours each day.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC sponsored attendance at the workshop for two teachers from each collaborative, paying for room, board, registration, and transportation. A total of four +PLUS+ teachers participated in the conference, with the collaborative paying the expenses for two of the teachers.

## Urban Mathematics Collaborative (UMC) Annual Meeting

The Annual Urban Mathematics Collaborative (UMC) Meeting, hosted by the Education Development Center, was held in Los Angeles on October 19-21, 1989, at Ma Maison Sofitel. All 14 collaboratives, including the 3 replication sites, sent representatives to the meeting. The reception for UMC members Wednesday evening, October 18, was attended by the team leads and principals from the +PLUS+ mathematics departments, as well as by representatives from the district offices, Board of Education, and corporate and foundation partners of the Los Angeles Educational Partnership.

The conference, "Everybody Counts--Strategies that Work," focused on equity. A panel discussion of local efforts to address equity in mathematics education was moderated by +PLUS+ Project Director Toby Bornstein. Phil Daro of the California Mathematics Project, Ruth Johnson of the Achievement Council, Grace Strauthers, principal of Jordon High School, Gene McAllen, principal of Audubon Junior High School, and David Crane, Southern California Gas, served on the panel. A short video was shown of Phyllis Hart, a counselor at Banning High School, talking about keeping options open. Among the questions the panel discussed were, How can mathematics reform issues address equity reform issues? and How can myths and stereotypes be broken? How can an effective counseling program excite teachers and students? Harold Boger, mathematics teacher and +PLUS+ team lead at Crenshaw High School, participated on a teacher panel to address equity. A keynote speech at the evening banquet was delivered by Henry Gradillas, former principal of Garfield High School, who is currently on loan to the State Department of Education.

Participants visited classrooms on Friday to observe teachers using a variety of teaching strategies within the diverse Los Angeles basin. It was clear to the visitors that students have an opportunity to learn mathematics and are encouraged to do so. The teachers who demonstrated lessons were: Harold Boger and Odessa Washington at Crenshaw High School, Chip Healy at Mountain View High School in the El Monte Union School District, Susan Daniels and Omer Hassan at Jordan High School, Barbara Komatsu and Eva Clark at Venice High School, Margaret Shoukry and James Gerald at Morningside High School in the Inglewood Unified School District, Lori McNeal at University High School, and Lorrie Freedman at Manual Arts High School.

## LAEP Leadership Conference

The Los Angeles Educational Partnership, in cooperation with the Educational Development Center (EDC) and the Los Angeles Unified School District, hosted a leadership conference for teachers in three LAEP projects: HUMANITAS, +PLUS+, and Target Science. Twelve teachers from each project attended the January 3-5, 1990 conference at the California Museum of Science and Industry. Seven out of the ten participating +PLUS+ teachers were provided with substitute classroom coverage and mileage. Five HUMANITAS teachers also attended. The conference was led by EDC consultant, Grady McGonagill. Prior to participation in the conference, teachers were asked to take the Myers-Briggs Type Indicator (MBTI). The questionnaire is based on the work of psychologist Carl Jung whose focus celebrates the value of individual differences. Grady McGonagill interpreted the answer sheets and disseminated the results to teachers at the conference.

After the opening session on leadership styles and understanding yourself in relation to others, United Teachers of Los Angeles President Wayne Johnson, the dinner speaker, addressed the group on power and leadership. The next session focused on interpersonal skills for leadership and utilized videotapes of participants in the act of practicing self-assertion and active listening. The last session before dinner stressed understanding and overcoming barriers to interpersonal effectiveness. After dinner, everyone participated in a power simulation.

The final day of the conference focused on "Power" and "Leadership as Vision," with Dr. Leonard Britton addressing the group during lunch. After lunch, the three project groups worked on individual and collaborative action plans to clarify their vision. The final activity involved a discussion of the problem of organizational decay and the prospect of organizational renewal.

One teacher said, "I enjoyed every minute of it. I always wanted to do something like this but it cost too much. +PLUS+ afforded me the opportunity. It taught me skills on how to deal with members of my department. The personality test was great!" A second teacher offered, "We explored our own personality and how we approach problem-solving. We had activities to help us listen better and get our own point of view across. It helped us formalize our vision and where we want to go. As a +PLUS+ team there we were far beyond the other groups that attended." Another teacher remarked, "I liked everything about it. They videotaped us in a practice situation and then we critiqued them." A fourth teacher said, "I loved it for professional reasons and the interpersonal skills I developed. Dr. Britton was interesting to listen to." A fifth teacher added, "The Myers-Briggs assessment of leadership style taught me much about myself."

Fourteen +PLUS+ teachers and two collaborative administrators attended a follow-up meeting on February 14, 1990.

## Mathematics Achievement Plan (MAP)

Eight collaborative teachers were invited to attend a planning meeting for Stage 1 of a collaborative effort between the California Achievement Council, the California Mathematics Project, and the Los Angeles Mathematics Equity Group. The collaborative is making an effort to increase student achievement in mathematics by building on existing mathematics resources and reform efforts. The +PLUS teachers were asked to assist in planning Stage 1 of MAP for secondary teachers. The first planning meeting was held at Venice High School on April 25, 1990. Toby Bornstein, Phil Daro, Richard Curci, and Grant Fraser served as Council members to guide discussion, direction, and planning. At this meeting discussion was initiated on the issue of having California State University at Los Angeles host the +PLUS+ workshops.

## E. Observations

### Project Management

The management of +PLUS+ reached its stride in the 1989-90 school year. The Teachers' Council met monthly, standing committees planned and coordinated major events, and the regional teachers' councils met for the first time. Additional schools joined the departmental planning process, which was facilitated by veteran +PLUS+ teachers. And for the first time, the LAUSD budget was determined at the beginning of the school year and funds were in hand. A core of mathematics teachers from 21 schools in the Los Angeles area were directing a collaborative. Teachers from another 8 schools had been initiated into the process and were well on their way to becoming full working members of +PLUS+.

Critical components of the collaborative had been developed and were working. Teachers with a strong sense of ownership in +PLUS+ were making decisions for the collaborative. Funding for the immediate future was secured. A cooperative host agency provided administrative support and a link to key people and groups in the community. A strategy for expansion and renewal had been developed and was being implemented. This strategy included a means for including more schools and teachers in the collaborative and procedures for dividing the labor so that people would not be overworked. It took five years, but a well-functioning collaborative has evolved.

Many factors have contributed to the success of +PLUS+ in reaching this advanced stage of management. Four of the most important are: (1) the development of teacher leadership; (2) the focus on working with mathematics departments rather than with individual mathematics teachers; (3) the ability to develop some financial security; and (4) the vision that +PLUS+ management had. To increase an understanding of these factors and the way they relate to the development of +PLUS+, each is discussed below in more detail. Even with the notable success +PLUS+ has achieved, there are some areas in which +PLUS+ program development has lagged. These also will be discussed.

The +PLUS+ program has been very successful in developing teacher leadership. This has been achieved through training, experience, and hands-on activities. Early in the existence of +PLUS+, retreat training sessions were held to help teachers identify problems and develop plans for solving those problems. Consultants were used to facilitate the training. In addition to these efforts, the process for developing departmental grant programs included steps for assisting members of departments to focus on a problem and then to work together to achieve its solution. Another form of training available through +PLUS+ was provided at the January 1990 three-day leadership conference at which 12 +PLUS+ teachers worked with others to become more knowledgeable about their own leadership styles, communication skills, and ways to realize their vision.

The formal training in leadership skills provided certain ideas and techniques, but it was through practice and learning-by-doing that the real gains were made. The +PLUS+ workshop series--begun in the 1986-87 school year--created an opportunity for teams of teachers to plan and produce a series of four days of workshops that would be presented to other teachers. Some of the small groups included representatives from higher education and business\industry. Mentored by the project director, the teams learned about deadlines, publicity, and planning experiences for adults rather than teenagers; they also reflected on what was achieved and how this could be improved. Each workshop day concluded with an evaluation session at which leaders reported on their experiences and, as a group, worked through any problems that occurred. During these four years, the workshops evolved to the point where teachers assumed essentially all of the responsibility for development and operation.

The departmental planning process provides another opportunity for teachers as facilitators to assume a leadership role by guiding groups of teachers through the process. During the pilot phase of +PLUS+, the first 18 months, the planning was not as formal. In the following three years, planning became more formal and was done primarily by the director and consultants. For the last two years, or the third phase, +PLUS+ teachers have been instrumental in facilitating the involvement of department teams in their planning process. Two years ago, in 1988-89, the teacher facilitators were given guidelines for facilitation a half hour prior to their work session with the new teams. This proved inadequate. During 1989-90, the teacher facilitators were given more preparation time, with the result that they were more effective in helping the new teams. The teacher facilitators have had an important role to play and, through helping other teachers, they have also increased their own awareness of how other departments function and of how to work with other teachers.

A third method +PLUS+ has used to give teachers on-the-job leadership training was to arrange for a teacher on release time to serve in the +PLUS+ office as a teacher coordinator. Sometimes this work was routine office work such as mailing, data entry, and writing memos, but the overall experience in 1989-90 gave two teachers basic knowledge of what is required to operate a collaborative such as developing an agenda, selecting supportive information material, and following up on those who had not attended to ensure they had the information needed. One duty of a teacher coordinator is to lead the Teachers' Council, thus providing another experience in leadership. Other teachers have been brought into the process by serving on Council committees that are responsible for specific tasks.

As a consequence of training and experience, a core of 30 or more teachers are well versed in exerting leadership and developing programs. These experiences, combined with other professional development skills acquired at conferences, workshops, and institutes in various parts of the country, have created a group of committed mathematics teachers motivated to reform mathematics education in the Los Angeles area. It is to this group that the mathematics supervisor turned when identifying and inviting teachers to join a newly organized district mathematics focus group.

A second major component of +PLUS+ has been to focus on departments. A team of teachers from a department, usually over 60 percent of the department members, engage in developing a grant and implementing their plan. As outcomes of this process, groups of teachers have worked together in their schools to improve their mathematics programs. This experience has generated new energy among teachers for making changes. It has reduced their sense of isolation. In some of the schools, new methods of teaching algebra and of increasing student interest in taking algebra have been tried. In other schools, different student incentive programs have been implemented. In still other schools, computers have been purchased to support the work of teachers in the department.

The departmental planning component has served as a means of initiating new teachers into the program. It has provided teachers with training in program planning and has given groups of teachers within departments occasion to work together. In some cases this has been the total department. One teacher admitted that the process has caused teachers in his department to think more about defining goals. He personally tries to set one goal for each year. He feels that writing the grants has made the department look ahead to the future and do some planning--"It did not happen before [+PLUS+]."

A real effort was made to get all teachers from a department to join the +PLUS+ departmental planning process. The project director visited prospective departments and presented the benefits of the program to all department members. Teachers were given a $50 stipend for attending the planning meetings. Even with these incentives, not all teachers were interested in joining. Because of the difficulty of getting 100 percent participation, a criterion of 60 percent participation by department members was established for +PLUS+ membership. This criterion made it possible for at least the majority of teachers within a department to benefit from the process and to contribute to change in the school's mathematics program. In many of the participating departments, a larger proportion than 60 percent of the teachers did participate. The project director reports that up to 80 percent of the +PLUS+ departments have increased their cohesiveness by completing the process. Some departments have important accomplishments to their credit, such as increasing the student enrollment in Algebra I and providing students with additional help in learning mathematics.

Even with its notable success, some people have raised issues about the +PLUS+ department program. The district mathematics supervisor values working through departments and has seen the value of +PLUS+ in doing this. He felt, however, that if departmental change really was going to take place, all of the teachers in the department had to be involved. This seems to be true in at least one +PLUS+ department, according to the department chair. He reported that after the year of implementing the +PLUS+ grant only two or three teachers out of about ten had remained active in +PLUS+. He acknowledges the difficulty in getting all teachers within a department to work together, "We all have the same problem of getting all of our department involved . . . it takes a lot of energy." A team lead at another school indicated a similar problem. Even though over 60 percent of the department participated in the planning process, only 4 of the 12 teachers were really active in +PLUS+. He described the others who were not involved, "They don't get in the way of anything we do, but for a number of reasons they do not have the time to put in the extra time."

The +PLUS+ department program has had an impact on a number of participating departments and has resulted in some change within the schools. Probably teachers from a greater number of departments have participated in the planning process because there was no requirement that all teachers within a department join. Individual teachers have benefited and, in some case, whole departments. The mathematics supervisor raised the issue of what would have had to be done differently to work with the department as a whole. It appears that stronger motivation was needed to get all teachers from some departments to join the process. Such motivation probably could not be provided without a district commitment to the process to make participation a requirement of their work or providing time during the normal working schedule for teachers to be trained and engaged in planning. Because +PLUS+ is a "voluntary" organization administered outside of the district's bureaucracy, it has no authority to get entire departments to participate. +PLUS+ had to make the program as desirable as possible to get teachers to voluntarily join. What +PLUS+ demonstrates is that with a well-orchestrated effort dependent on the work of teachers, 29 departments and over 400 teachers have found the program of such value as to meet their criteria and merit their participation.

The teachers have contributed directly to the success of +PLUS+ in achieving some financial security. The district has made a commitment of $230,000 a year for +PLUS+ support. This commitment was made after a group of +PLUS+ teachers made a presentation to a committee of the LAUSD School Board based on the considerable amount of ground work by LAEP and +PLUS+ with the LAUSD administration. At the time, the person who is now the president of the School Board was serving on the committee. She explained that one of five reasons that the request was granted was because of the enthusiasm of the teachers for the program, "The people who made the presentation before the committee were very enthusiastic . . . and that helps." The other four reasons were: the program focused on urban poverty which coincided with a Board priority; there were matching funds; the program could be replicated and had a strategy for growth; and it was operated by LAEP, which has credibility. The combination of district resources and funds from the Ford Foundation has enabled +PLUS+ to develop a strategy for expanding to a large number of schools in the Los Angeles area. As a consequence, +PLUS+ has been able to meet its financial obligations more effectively than other collaboratives.

The fact that the Los Angeles Education Partnership hosts the collaborative has been important to its development and its ability to raise funds. As noted by the president of the School Board, LAEP has credibility. LAEP has provided a link to the business community while at the same time serving as a friend to the schools. Since the collaborative office has been located in LAEP facilities, extra personnel have been available at times to help with mailings and printings. The director of LAEP also is able to reach the attention of critical people, such as the superintendent of schools, when needed.

Finally, the management of +PLUS+ has been very effective in sustaining the vision of +PLUS+ and making the enterprise work. The director has been influential in designing the collaborative's overall approach. She has insisted on identifying problems, looking for barriers, developing strategies to remove barriers, and reflecting on what was done. This problem-solving approach is embedded in nearly everything that +PLUS+ does. Another contribution of the director has been to encourage teachers to think beyond what is, to what can be. The director has compelled teachers to think about what should be happening in five years and beyond. This has caused teachers to become involved in long-range planning and to think beyond the status quo.

Essential to the successful development of +PLUS+ has been reliable assistance in running the office. Collaboration requires personal, one-on-one interaction. It requires meetings after school hours and on weekends. It requires keeping people informed of activities, sending them reminders to attend, and following up when a person has not been heard from. Ms. Bornstein has been fortunate to have had an administrative assistant, Debbie Novick, who served in that capacity for three years, from 1987 to 1990. Even though Ms. Novick valued and enjoyed the work she was doing, she suffered burnout in the position and took another. One factor responsible for the increasing work load was the expansion of the program. Increasing the number of schools meant an increase in the number of people calling each day, each one requiring some response. The questions varied: "One just doesn't know how to fill out a form. One wants to know what kind of research, because we have built up some videotapes . . . and one wants to know what we have. Another one didn't get a check. Another wants to know if we can find out about a book or a conference. . . .Another one just wants to call and talk and complain about something in school." The administrative assistant saw these personal interactions as the most important part of her work.

The administration of the +PLUS+ program has been complicated by the number of different components associated with it. Asked about what the administrative requirements are for operating a collaborative, Debbie Novick replied, ". . . part of it is the number of projects and components that you have going simultaneously. We have levels of schools. We have groups of schools that are at different levels in the program. One is implementing a proposal. One is implementing a continuing proposal. Others have opted to do a report so they are not really worried about money, but they are doing other things. We have the workshops going. There is the Woodrow Wilson Fellowship that comes every year . . . a one-week program takes three weeks of planning at +PLUS+." Having teacher coordinators has helped some, once they were trained. But the requirements for operating a multifaceted program are different from the requirements for teaching, and the transition from one to the other takes some time.

An issue facing +PLUS+ is how to live within budget. +PLUS+ has been successful in bringing more schools into the program. The regional councils have been launched. In the past, adding new components to the program has increased the responsibilities of the administration. It is unknown how much administrative support will be needed now that there are four teachers' councils. There also is a question as to whether the regional councils will be able to generate a commitment among the teachers needed to serve on the committees that make the program work. During 1989-90, some teachers served on three different committees. The time this requires of a teacher may lead to collaborative burn-out by those most committed. The number of program components and the work that needs to be done can rapidly outgrow the level of administrative support available and the commitment of teachers who are willing to do what is required. One warning that +PLUS+ has received from an LAEP board member is to focus the program on what can be done well and not try to do everything. The need for a sharper focus was cited by a mathematics department chair very active in +PLUS+ as a way the collaborative could improve. He felt that such focus could be achieved by deciding on something specific that +PLUS+ could accomplish and then saying "This is our goal." He admitted that the program was heading in that direction, but "we need to be a little more goal oriented on a more practical level."

Another structural issue that has not been resolved is the development of a program for establishing formal links with those in business/industry and higher education. As the collaborative now exists, it is teacher directed. The primary form of collaboration is among teachers. The Advisory Committee, formerly called the Urban Mathematics/Science/Technology Committee, has undergone study during the year to determine what sort of coordinating group would be the most valuable. Such a group seems essential in developing formal relationships with the business and higher education communities. At present, the relationships between these communities and the collaborative are formed by individuals or through LAEP, rather than being a formal part of +PLUS+.

## Collaboration

The major form of collaboration is among teachers. The structures that have been created and are in place encourage this basis for collaboration. The regional teachers' councils, the workshop series, the site visits, and the departmental planning process are all primarily focused on teachers working with other teachers.

Teachers and departments become active in +PLUS+ for different reasons. In some cases, teachers have encouraged their departments to become +PLUS+ departments because individuals in the departments were not interacting. A teacher, in his first year of teaching, read about +PLUS+ in a district publication, "I thought it sounded like something that our school should be involved in . . . I simply felt that our school needed some type of activities to get us to come together because . . . we just came to work every day and did whatever we were supposed to." This teacher was motivated to work with others in the department because he did not feel that a single teacher working alone could make a difference.

Other departments were already working well together and saw +PLUS+ as an opportunity to obtain funding and implement ideas that teachers had begun thinking about. One teacher reported that when her department chair first mentioned +PLUS+,

". . . it turned out that there were several teachers who had various ideas. . . .they saw +PLUS+ as an opportunity to implement these. So we got together . . . and put our name in the hat . . ." Although gaining more resources for the department was the initial incentive for joining +PLUS+, the real benefit came from working together: "We initially went into +PLUS+ with very definite ideas about wanting to implement a set program . . . the financial resources and the business resources that +PLUS+ offered us were the direct incentive. The collaboration was secondary. . . . But in the long run . . . [the developed collaboration] has been probably the most effective component."

The collaboration among teachers has resulted in one of the most important outcomes of +PLUS+--networking among teachers and between teachers and others associated with +PLUS+. A teacher from a 1989 +PLUS+ school valued what he has learned as a result of talking with others, "What I have learned this semester . . . is that I have to keep on talking. If I have a question or concern I have to talk about it and then Toby, or somebody else can direct me to somebody else . . . one things leads to another and before you know it you have really found out more than you wanted to know . . . I think the power is in the communication." Another teacher put it simply, "The whole concept of collaboration itself is two heads are better than one." The networking among teachers has given them a support group, a rich source of ideas, and a visible organization that is recognized as an active force when mathematics education in the Los Angeles area is addressed.

There has been interaction between teachers and some interaction among those in business, industry, and higher education, but it has not been extensive. As noted above, +PLUS+ has not developed a formal structure for generating collaboration between teachers and those in higher education or business. It has remained primarily the responsibility of individuals to develop this interaction on their own. An important recognition is that the core of teacher leaders that has been identified and developed through +PLUS+ provides a powerful attraction to those in the other sectors to become more meaningfully involved. A professor from a local university said that the most important factor in his agreeing to work on a team to develop a workshop for the workshop series was that a teacher asked him to participate. For him the crucial feature of the program was that it was a grass roots program, beginning with teachers. Because he has many opportunities to consult and to be active beyond his university responsibilities, he is very selective about what he does. If the district superintendent or associate superintendent had approached him, he implied that he would probably have refused the offer. What was different about +PLUS+ was that a high school mathematics teacher had asked him to become involved. That request impressed him. The professor also expressed enthusiasm for the integrative effort that +PLUS+ makes in some of its workshops to cut across more than one discipline.

The professor donated his time and felt that he received something in return. He felt that he had gained from participating in the program and noted that he is now aware of programs such as that of the North Carolina School of Science and Mathematics. He stressed the importance of long-range planning, but cautioned that this could reduce the program's flexibility to respond in different directions when there is a need.

A few of the mathematics teachers have had significant interactions with people in industry and business. These interactions occurred as those from industry worked with teachers, as a team, to present a workshop or through the Teacher Associate Pairs program. The departmental grants also have generated some projects of this type. A +PLUS+ team lead at one school reported that the continuation grant proposal included a provision for making contacts with local businesses to develop community resources. However, a large number of mathematics teachers, active in +PLUS+, have not experienced interaction with persons from other sectors in the program.

Many gains have been made simply as a result of teachers working together. One challenge facing +PLUS+, as it reaches greater stability in its administrative structure, is the development of resources outside the organization that can be brought to bear on solving the many problems that face mathematics teachers and the demands of mathematics curriculum reform. In a sense, this can be a test of the empowerment of teachers. It is the empowerment of teachers that impresses those in industry and higher education and stimulates them to contribute. Teachers are critical in attracting those from the other sectors and in getting them to participate. The relationship that is created becomes genuine and mutually fulfilling. It is up to the teachers to recognize the importance of these linkages, to have clear ideas about the value of seeking support and resources from those in industry and higher education, and then taking the initiative in involving members from these sectors in +PLUS+ activities. One mathematics teacher acknowledged the importance of working with people in business, but only after she has reached a level of satisfaction in her own teaching, ". . . before I can bring business in I have to first clean house here . . . the problem with teachers is how they feel comfortable, how they have structured their classroom, and how they are teaching daily. . . .more interaction with business would be a great benefit to my students but it takes a certain amount of time to develop that as a resource and I just haven't been willing to set aside the time to make it sell. . . .I think it is the least appreciated component of +PLUS+ and my fear is it will atrophy as a result of lack of use."

**Professionalism**

Many forces are exerted on mathematics teachers to isolate them in their classrooms as they teach their daily textbook lessons: the district-specified curriculum, teaching five periods a day, lack of professional development opportunities, the demanding paper work required by the administration, and having classrooms in parts of the building that are distant from other mathematics teachers. +PLUS+ strives to work with mathematics teachers to neutralize these forces so that mathematics teachers network with each other, become active in getting teachers to plan and work together, and seek professional development experiences for themselves and their colleagues. The accomplishments to date have taken time and continual pressure. The LAEP director noted that the conditions of the Ford Foundation grant and the contributions of a number of people were critical: "+PLUS+--in the first eighteen months it dealt with the three departments--was probably the toughest experience we have had . . . if we had not had the flexibility, the Ford funding, the long termness of it, and a lot of people interested in mathematics and science who have invested in it for three years, I think we would have walked away."

One order of business a collaborative faces is obtaining teacher responses regarding attendance at an event. This is a small issue, but an important one in operating a low budget collaborative that has to account for each meal paid for and submits paper work to have teachers paid stipends for attending events. The lack of response, or a late response by a significant number of teachers, reveals certain conditions that prevail in teaching but are not found in other professions.

The administrative assistant has experienced frustration when teachers have not responded to an RSVP, or deadline for submitting materials. She noted that after an announcement of an activity is sent to all teachers, ". . . they will call up two days before and will say they never got [the announcement]. And I will describe it, because we used every color on the spectrum. 'Okay, maybe I did get that. Could you tell me again?' They get it and don't read it. . . .Some are very organized, but many are not as organized as they could be. . . .I think part of it is being in the classroom and they set up their own little system for what they do but they don't know how to add other things to that." The assistant contrasted this with what happened when she worked with people in business, "As soon as the business people get the announcement, they will check their calendars and respond, either personally or have a secretary respond. Teachers do not do this. One reason is probably they do not have the same support system that those in business have. And part of it is, too, the executive is sitting in his office. He has his calendar right there. If he needs five minutes to make a phone call, he has it. Teachers don't have that kind of support. . . .They don't have the support in the schools that they actually need."

When those associated with the collaborative are asked to reflect on how professionalism relates to teaching, different attributes are identified. One mathematics teacher felt that for teachers to be professional they need to be accountable. Another teacher noted the importance of continually upgrading their teaching skills through gaining new ideas, making changes in the classroom, and seeing what other teachers are doing. One collaborative member who had previously worked in the aerospace industry went into teaching because it would be more fulfilling. He felt that teaching was the most important profession in the world. For him the classroom teacher has more freedom than others in education, more than administrators, and much more than he had in industry. Another active +PLUS+ teacher views teaching as a profession because in teaching there is always room for growth. This requires periodic updating in teaching methods and skills. For her, teaching as a profession also requires creativity, decision making, and critical thinking. These views coincide with those of the project director who believes in the importance of teachers reflecting critically on what they do, "The thing that is hard to act on is the need as a professional to demand professional behavior from their peers and their colleagues." Another teacher does not think that teachers have reached professional status because they are not willing to have people observe them, offer comments, and to evaluate what they do. +PLUS+ is encouraging teachers to do this, but still more needs to be done, ". . . we need to be able to talk about problems and be able to change. Otherwise you just have a job."

Site visits, which enable teachers to visit the class of another teacher, were initiated to help teachers become more reflective regarding their own teaching and the teaching of others. This initiative derived from the felt need that some teachers had to see others teaching in order to make changes in their own practice. The site visits were poorly attended, but the director will continue to push them because of her belief in the need for teachers to interact with each other about their teaching. In some of the schools, teachers who have made site visits return to discuss what was observed with the other teachers. There is some thought in the future of videotaping the class to facilitate discussion. All teachers, of course, have not experienced this opportunity for critical reflection. When asked how much of this takes place, one teacher commented, "It doesn't. We have a little empire in our own classroom. And nobody comes in and disturbs you."

Another way that the collaborative enhances the professional lives of teachers is by expanding the group of teachers available who can be called upon for support and new ideas. This expanded support group gives teachers encouragement and confidence. The collaborative, according to a department chair, "gives you the feeling that you are moving toward accomplishment . . . and that you have control over making your profession better." This relates to the most frequently noted outcome of the collaborative by teachers--networking among the members of their profession. This has been observed by the district mathematics supervisor, who described the improvement in the working relationship among teachers in a department as an important outcome of the collaborative: "I see more of the people within a department talking to each other and helping each other."

+PLUS+ has fostered structural change in some mathematics departments. Some of the +PLUS+ departments have team leads who are different from the department heads. One teacher assuming this position reported that the responsibilities of the team lead complemented those of the department head so that more is accomplished. This structure serves to distribute leadership responsibilities among a greater number of teachers. The team lead is also given either some additional money or a released period. Other departments have been creative in deciding how this time is used and shared the hour with other teachers.

+PLUS+ has changed the professional climate for at least some mathematics teachers in the Los Angeles area. These teachers are exhibiting leadership in new ways. They are talking with one another and sharing ideas. They are specifying goals and working toward achieving those goals. A few are serving on district committees. An increasing number of teachers are taking advantage of site visits and are being more reflective regarding teaching. They have an increased awareness of professional development and an interest in actively seeking and taking advantage of such opportunities when available. The creation of this climate was the work of many teachers and others, but it also was a vision of the project director. When asked in the beginning about what she thought the program should be, Ms. Bornstein commented, "I believed that we could cause it to happen . . . by giving [a group of math teachers who really wanted to see change happen] opportunities to grow . . . to learn and to lead . . . that there would be one day an organization that would enable them to pursue their professional goals." What had to be in place for this to happen was for teachers "to feel support . . . have autonomy in making decisions . . . [the belief that if they] have a goal and stick to a plan . . . they could make things happen."

### Mathematics Focus

A dominant factor in setting one mathematics focus for +PLUS+ has been the California *Framework* and the districts' curriculums. The workshops in the workshop series were designed to support the content of the *Framework*. Individual departments, however, identify their own focus through their departmental planning. This creates more diversity in the mathematics that is addressed through collaborative activities.

One district's initiative is to increase the number of students who take algebra. According to the mathematics supervisor, the teaching of algebra needs to be changed if all students are to have access to the course. For all students to be successful in algebra, the course needs to include statistics and probability, manipulatives need to be used more, as do calculators, and cooperative learning and small group instruction. The supervisor notes that to achieve this will require a significant professional development effort. This creates a major logistical problem in a district of 1,700 designated mathematics teachers and another 1,000 teachers, such as special education and Chapter I teachers, who teach at least some mathematics. For example, to excuse teachers for inservice attendance would be expensive and would be a contradiction for those teachers who feel that their place is in the classroom. One active +PLUS+ teacher addressed this issue, "I would like the collaborative to decrease, if possible, the amount of classroom time that is lost. . . .Every time that a teacher is gone from the classroom there is a break between the teacher and student in the relationship that is [essential] to the learning experience. . . .Every time [this relationship] gets interrupted, I find that distasteful plus, while it provides opportunities for professional growth, it does it at the expense of classroom time . . ." This teacher goes on to object that many of the best classroom teachers are serving less time in the classroom and more time using their leadership skills with the collaborative. +PLUS+ has helped to provide professional development experiences for mathematics teachers. However, this one teacher raises an important issue: as +PLUS+ helps teachers develop their leadership skills, does it mean that these teachers are doing less teaching? There also is the potential that as a very effective teacher works with a number of other teachers, a greater number of students will benefit than if that teacher remained only in the classroom.

Departmental grants are generating ideas on the part of teachers regarding how problems in the teaching of mathematics can be resolved. For example, one department wanted to work towards encouraging more students to take algebra. To provide extra help for students, this department developed an early morning algebra class as its +PLUS+ project. One result is in 1989-90, a higher percentage of the school's Algebra IA students advanced to Algebra IB than in previous years. This program is made possible by having a mathematics teacher arrive an hour earlier at school to teach the class. The teacher then finishes the school day one hour earlier. There is no cost to the department and there is a distinct benefit to students.

Another positive outcome of +PLUS+ has been the sharing of ideas among teachers as they become more comfortable with the process. One teacher illustrated the value of having mathematics teachers communicating regularly with each other. She noted that before +PLUS+ existed, whenever mathematics teachers got together, the initial activity consisted of venting their anger, "It is like, there is all this pressure built up in the individual . . . when you finally have someone who you know would understand . . . then you can go on to problem solving." Through the collaborative, the teachers communicate with each other, which has resulted in more productive conversations. In response to the problem of having difficulty in describing the set of real numbers to algebra students, another teacher shared her idea of using nested boxes, the largest one representing the real number; inside this box were two, one for rational numbers and one for irrational numbers; and so on. The teacher said, ". . . you could view in ten minutes what you have been tearing your hair out to get across in an hour without success. . . .It was one of those things where I as a teacher, and my students benefited, from this whole idea of collaboration." She went on to note, "As we as a department get stronger, we cannot, as individual teachers, help but reflect on our student's achievement. I just don't see how it will work otherwise. So that's without benefit of saying, 'This is exactly something we want to change.'"

A teacher who had attended a conference in North Carolina gave another example of an idea he has gained from his collaborative experience. By putting a foot long ruler on an overhead and moving the overhead forward and backward, students can make measurements of the projected image of the ruler on the screen and relate this to the distance the object is from the screen. This provides a practical solution for applying proportions and ratios.

+PLUS+ is making some impact on mathematics education in the Los Angeles area. +PLUS+ has attracted the attention of the School Board because it represents a subject area which is of Board concern. The president of the Board observed: "Math is a gate-keeper." The program has also helped teachers engage their students in their own learning. One active +PLUS+ teacher uses this as a criterion for good teaching, "I know I have done a good job when the kids don't need me anymore, when they are independent of [me] and are learning as much from other people." As one of the three most important outcomes of +PLUS+, a teacher noted the introduction of technology as a tool that can be use to motivate students who have not been successful in mathematics. A third +PLUS+ teacher reported that the collaborative has helped him to be more realistic about what he was supposed to teach his students by giving him more realistic knowledge of what students will need when they graduate. This teacher is doing more with everyday materials, such as having students read graphs in the newspaper and using statistics. Another teacher reports, "+PLUS+ has made me feel that you have to involve the students more so that they can feel a part of the learning process . . . I constantly try to use a different approach." These comments and the list of activities that teachers have engaged in through +PLUS+ are a testament to the impact the collaborative has had.

## F. Next Steps

At the conclusion of its fifth year, +PLUS+ has begun an expansion program, having launched the West Satellite Teachers' Council in February of 1990. North, South, and East Satellite Teachers' Councils were launched in June, 1990. Many of the activities that have proven successful in the past will be continued in 1990-91, within all four Councils. Each regional Council will send representatives to four standing committees: the Escalante Awards, +PLUS+ workshops, the Annual Conference, and Communications Committee.

A variety of opportunities for professional development will be available for +PLUS+ teachers during the summer of 1990. From July 30-August 3, 1990, a team of instructors for the Woodrow Wilson Summer Institute will present a one-week session on Data Exploration at the Osage Professional Development Center. Two teachers, one who had been in the collaborative for six years and some who had only been in +PLUS+ for one year, will be sent to the EDC Leadership Conference in New Hampshire in August, 1990. Another teacher will use a partial grant to attend a regional NCTM meeting in Hawaii in July, 1990. Rockwell, in conjunction with the IISME program, will offer a summer 1990 internship to a collaborative mathematics teacher.

Twenty-nine +PLUS+ schools across four districts will get together on September 22, 1990, to kick off the 1990-91 school year. All +PLUS+ schools that have implemented a proposal are eligible to write continuation grants; the proposal deadline is September 21. Each satellite Council will vote on the continuation grants for the schools in its region.

The +PLUS+ Workshop Series will again be offered in 1990-91; the Los Angeles campus of California State University will be the new location for all workshops in the 1990-91 series. +PLUS+ will also assume coordinator duties for the third annual Jaime Escalante Award Program.

Members of the Teachers' Council will be working during the summer months of 1990 and into the fall refining plans for a mathematics/science competition. This will be funded partly by an EDC Outreach Action Grant of $5,000. +PLUS+ teachers are to work with teachers in Target Science and HUMANITAS to develop problems that integrate mathematics with the physical and social studies. These problems will be shared with other teachers at workshops. Then a student competition is planned for spring, 1991.

LAEP will receive a $7,000 grant from City Bank to support (1) mathematics and science teachers' development of ideas for integrating mathematics and science and (2) to improve teachers' grant writing skills. A three part workshop is planned for a total of 16 hours. Eight hours will be spent on brainstorming ideas. Then two four-hour sessions will be devoted to developing ideas for grants and then getting these reviewed by others. This is a joint program of +PLUS+, Target Science, Model Technology Schools, and IISME.

LAEP will submit a proposal in November, 1990, to Hughes Aircraft Company for two annual grants of $65,520 in 1990-91 and $84,112 in 1991-1992 to implement the first two years of the Hughes Partners in Science and Industry (PSI) Initiative. This program is to team Hughes retirees with +PLUS+ and Target Science teachers who teach predominantly minority students. The program will pair Hughes retirees, based on their expertise, with teachers based on their subjects they are teaching. One purpose of this proposal will be to fund an umbrella program to help strengthen the Teacher Associate Pairs (TAP) program.

The Mathematics/Science/Technology Council will be reconvened with 27 members in the Working Group. The membership will consist of 15 from corporations and businesses, one from the United Teachers of Los Angeles, 7 from school district administration, 2 teachers, and 2 from LAEP. The CELOs will meet in the fall. The first meeting of the Working Group will be December 13, 1990. The purpose of this group is to bring together the business and educational communities in the Los Angeles area to (1) focus human, financial, and intellectual resources on resolving the current crisis in mathematics and science education, and (2) create a ten-year action plan to improve student achievement and learning in mathematics, science, and technology. The Working Group plan is to be presented to the full Council in the fall of 1991.

# SUMMARY REPORT:
# MEMPHIS URBAN MATHEMATICS COLLABORATIVE

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Memphis Urban Mathematics Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Memphis Urban League to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts in January , 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district; and two site visits by the staff of the Documentation Project.

# MEMPHIS URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

In its proposal for continued support from the Ford Foundation, submitted May 31, 1989, the Memphis Urban Mathematics Collaborative (MUMC) was presented as a dynamic organization under the leadership of mathematics teachers in association with their supporters from the Memphis City Schools, businesses, and academic institutions. The perceived purpose of this alliance is to work together to improve the profession of mathematics instruction and the results of mathematics education in Memphis. Overtly focusing on the results of mathematics education represents a change in purpose from a previous orientation primarily toward promoting the environment of professionalism for mathematics teachers through their working with others in business and higher education. The goal of the collaborative was expanded to make provision for including elementary schools, working with the Memphis City Schools administration, and seeking greater public awareness. The goals of the collaborative as stated in the May 1989 proposal are as follows:

Since teachers and other mathematics professionals are dedicated to students' learning and appreciating mathematics and its usefulness, the collaborative will continue to:

1. Promote an environment of professionalism;
2. Promote closer creative working relationships with other professionals in elementary and secondary schools, colleges, and universities, and in business and industry;
3. Develop additional creative projects which will broaden teachers' horizons;
4. Seek additional financial commitment and moral support from the Memphis City Schools administration; and
5. Promote greater public awareness of the work of MUMC and its constituents.

## B. Context

Memphis has an urban population of 659,000, approximately 50 percent white and 50 percent non-white. Existing large corporate employers, as well as several new business ventures that have been attracted to Memphis, account for a relatively healthy economic climate. The city has invested $54.5 million in the Great Pyramid Project in downtown Memphis, as part of a combined revitalization program and tourist attraction. The influx of new business has generated additional need for trained and skilled workers and has also cut the county's jobless rate to 3.9 percent as of September, 1989.

The Memphis City Schools Board of Education is composed of nine members, elected by Memphis voters. In December, 1989, J. C. Williams was elected Board president, for a one-year term. William W. Herenton, the Memphis City Schools (MCS) system superintendent, has been in the position for eleven years and earns an annual salary of $91,360, with fringe benefits bringing his contract's total value to $101,000. His current contract expired June 30, 1990, but under its terms, he received an automatic one-year extension from the Board of Education. Exactly how long Dr. Herenton would remain as superintendent was questioned because of certain allegations made during the year in the press and by some Board of Education members. Dr. Herenton continued to receive strong support by a large segment of the community.

In August, 1989, Superintendent Herenton reiterated three goals for the Memphis schools that he had set in 1987. The first was that by 1991, 90 percent of Memphis City Schools students leaving the 3rd-grade will be performing at grade level in reading and mathematics as measured by the system's criterion-referenced tests. To meet that goal, the Focused Instructional Program (FIP) was developed as a means for improving achievement. The second goal was to increase the number of students entering the 9th-grade who go on to finish their high school education, and the third is to increase the availability of the Optional Schools Program by 25 percent.

In May, 1989, the Memphis School Board hired an independent North Carolina company to investigate and evaluate the school system's personnel practices. The survey reports delivered to the Board in September, 1989, made recommendations for improved school system management and personnel practices. Superintendent Herenton subsequently proposed teacher layoffs, students reassignments, and school closings in order to achieve efficient school management. He also offered a plan to build new schools and consolidate and close others. Shifts in student population and personnel were needed in part due to the poor physical condition of building structures and the high mobility of student populations throughout the city.

Since February of 1989, a committee of Memphians has been studying the possibility of consolidating the City and County school systems. In the City schools, elementary enrollment is rising and secondary enrollment is dropping. Consequently, City elementary schools are suffering from overcrowding at some sites. County enrollments are expanding. Many of the schools in the City of Memphis need major repairs or are structurally unsafe. There are not enough County schools to accommodate the influx of new students; during 1989-90, the County schools enjoyed a 1,500 student population increase. Comparatively, the City system has 98,000 students of which 79.3 percent are black; the County system has 36,000 students and is 85.3 percent white. A combined enrollment would change the black school population percentage to 62.6 percent. Both systems are under federal desegregation guidelines that date from the 1960s and 1970s. Consolidation would require significant restructuring of educational, funding, and equity goals to accommodate existing desegregation guidelines. A target date of August, 1990, was set to present the issue to the voting public.

School district expenditures for the 1989-90 school year were $313,025,244, with a projected budget for the 1990-91 school year of $327,568,242. Federal funding accounts for 2.25 percent of the total budget, state funding for 44.8 percent, local funding for 33.47 percent, and other sources for 19.48 percent. Other than an income tax on investment income, Tennessee has no income tax. It does have a combined state and local sales tax rate of 7.75 percent, one of the highest sales tax rates in the nation. To increase state funding for education, implementation of a state income tax structure may be a logical next step. At the conclusion of the 1988-89 school year, $1,070,000 in operating surplus remained, bringing the reserve contingency funds total to $24,000,000 at the beginning of the 1989-90 school year. During 1989-90, Memphis City Schools (MCS) had a budget of $321,200,000. The County provided $61,500,000 of the City Schools budget and the City $37,100,000, primarily from property taxes. The proposed budget for 1990-91 is $338,500,000, and would require a 34.3 cents per hundred of assessed value city property tax increase. Currently, out of a total city property tax of $3.31 per $100 of assessed value, $1.03 supports the schools. In May, 1990, the City School Board passed a maintenance level $327,500,000 budget. MCS ranks 15th in state per-pupil funding at $3,657, compared to $2,923 in Shelby County, which ranks 68th in the state.

The Memphis City Schools district consists of 152 schools: 24 senior high schools (grades 7-12); 15 junior high schools (grades 7-9), 2 middle schools (grades 5-8); and 85 elementary schools (grades K-9). In addition to the standard curricula, 26 optional magnet programs have an 11,000 student enrollment, which represents approximately 11.5 percent of the system's 98,000 total enrollment. About 15 percent of the students in the district attended private/parochial schools in 1989-90; the percentage has decreased since 1988-89. Approximately 56,400 of the City system's 98,000 students are eligible for free or reduced-cost lunch programs and families of 26,300 students receive public assistance.

Of the 98,000 students enrolled city wide, 49,697 are males and 48,392 are females. Of 19,860 high school students, 9,653 are male and 10,207 are female. Within the male population, 77.5 percent are black and within the female population 78.2 percent are black. The high school and middle school pupil/teacher ratio is 25:1 and for grades 4 to 6, 28:1.

The district does not officially compute a dropout rate. However, in 1988-89, the annual dropout figures were: high school--1,872 students; junior high school--1,173 students; elementary school--1,137 students. At the high school level, the dropout rate for the year was 9 percent. For all grades the dropout rate for the year was 4 percent. Both the school system and several community organizations have been developing programs to keep students in school. School officials announced in September, 1989, that law enforcement officers will make an extra effort to curb truancy. Juvenile Court Judge Kenneth Turner has called for stronger enforcement of a seldom-used juvenile curfew law. The judge advised that parents of children who are habitually truant could go to jail and lose custody of their children. Tennessee law requires school attendance between the ages of 7 and 16. On September 15, 1989, the Ford Foundation Urban Dropout Collaborative held a forum at Northside High School in Memphis on how to prevent children from dropping out of school. The program, launched in 1988-89 as a pilot, targets young students and is making an attempt to lower the City Schools dropout rate. In December, 1989, a one-day education conference, sponsored by Shelby State Community College and the Ford Foundation, was held at the Radisson Hotel in Memphis to address teaching strategies for youths at risk. Educators from 25 cities attended.

In May, 1990, members of the first graduating class from Middle College High School (at Shelby Community College) received their diplomas. Superintendent Herenton and other Memphis education officials conceived the idea for the school in 1986 after attending a Ford Foundation conference on students at risk. The school opened in 1987 with 89 10th-graders who had high-risk potential dropout profiles and more students have joined the program since 1987. In 1990, a total of 65 students graduated, half of whom plan to go to college in the summer or fall.

Standardized ACT mean test scores in Tennessee dropped from 18 in 1988 to 17.9 in 1989. In Memphis, composite ACT scores dropped from 15.1 in 1988 to 14.9 in 1989. ACT batteries are administered to seniors who choose to take the test. In 1989, the average ACT score for the nation was 18.6 (out of a maximum score of 36) , a decline of 0.2 from the previous year.

Tennessee high school graduation rates rose from 67.8 percent in 1988 to 69.3 percent in 1989; MCS graduation rates were 61 percent for 1988. This graduation rate is inclusive of all students, including those in special programs and schools. Follow-up studies of MCS graduates for 1989-90 showed that 58 percent continued on to postsecondary education. An MCS high school diploma requires two units of mathematics, while an honors diploma requires three units of mathematics.

The teaching staff in Memphis totals 5,871: 1,359 high school teachers; 1,123 in junior high; 30 in middle school; and 3,359 in elementary school. The high school ethnic population for teachers is as follows: 717 white; 630 black; 2 Spanish-Hispanic; and 10 Asian/Pacific Islander. The teacher racial ratio for all other levels is very close to 1:1 for white and black teachers. Three hundred fifty mathematics teachers are also equally divided between black and white.

The teacher salary minimum in 1989-90 was $20,200 for those with a bachelor's degree. A salary maximum of $37,790 for 1989-90 required a Ph.D. The salary average for 1989-90 was $27,177, for a 200-day school year, which was above the state average of $25,619 but below Shelby County's average of $27,432. All teachers received 10 paid inservice days during the school year. In August, 1989, the Board of Education distributed a schedule of teacher salaries within the school system. The Bargaining Team members were in disagreement about how they were calculated; the Memphis Education Association (MEA) subsequently filed a grievance over the issue.

The State of Tennessee administers the Teacher Career Ladder Program (CLP). Approximately 266 hours of extra work on approved projects will yield an additional $4,000 in teacher pay. CLP involves three experience/salary levels. At Level 1, teachers must have four years of teaching experience and pass the National Teachers' Examination, for which they will receive a $1,000 bonus for a 10-month contract. Level 1 teachers with nine years of experience can obtain Level 2 status, with a choice of one of two evaluation models, announced in August, 1989. Level 2 teachers receive a $2,000 bonus for a 10-month contract, and can receive another $2,000 if they work an additional month. Level 2 teachers with 13 years of teaching experience can reach Level 3 through an option choice similar to that in Level 2. Once attained, Level 3 teachers can receive a bonus of $3,000 for a 10-month contract and earn an additional $2,000 for 11 months, or $4,000 for a 12-month contract. Contract career ladder activities must focus on high priority student needs. Pending state approval of the MCS master plan of activities for career ladder candidates, teachers could not begin the extended contract activities until permission was granted by the MCS personnel office.

The current teacher contract, which was approved in December, 1988, expires June 30, 1991. Sixty-two percent of the teachers (or 58% of the total bargaining unit) are, through dues deductions, members of the Memphis Education Association, which is also their bargaining agent. During the 1989-90 school year, the Board of Education introduced a resolution that would require random drug testing of all City Schools students, employees, and administrators. However, the Memphis Education Association opposed the mandatory school employee drug-testing resolution, claiming it was an unwarranted and unconstitutional invasion of privacy. In June, 1990, the resolution was referred to a School Board personnel committee for review.

**Professional Opportunities for Teachers**

In honor of Teachers' Day, March 6, 1990, the MEA hosted a banquet at the Marriott Hotel. The evening featured a social hour, dinner, and Dr. Manning Marable as the keynote speaker. Dr. Marable is a social critic, author, historian, and political activist who writes a published column, "Along the Colorline."

MCS announced a new concept that allows teachers to select an inservice project they want to attend outside school hours. In return for six hours of professional development credit, teachers were allowed to forego attendance at a city-wide inservice program in March.

The Memphis Rotary Club awarded 368 Teacher Initiative Grants with a top dollar per-grant award amounting to $200. The entire grant program totaled $42,000. MUMC teachers have taken advantage of this opportunity, but no formal records were kept to determine how many teachers were grant recipients.

In the spring of 1990, the Division of Curriculum Development of the Memphis City Schools offered grants to selected elementary and secondary teachers to allow them to take courses in mathematics, computer science, and mathematics education at Memphis State University. A teacher was allowed to take only one course. To be eligible for the tuition grant, the applicant had to satisfy the admission requirements for Memphis State University.

## Business Support of Education

Business involvement with education is at a high level in Memphis. A total of 235 businesses and 4,000 volunteers from churches and community agencies are working with the system's 152 schools. The Memphis Youth Initiative (MYI), organized in October, 1988, has a 21-member Board which screens ideas and plans of private companies/organizations that want to invest in public education. Original sponsors include AutoZone, Inc.; Dunavant Enterprises, Inc.; Federal Express Corp.; First Tennessee Bank, and Holiday Corporation. A vice-president of Holiday Corporation serves as the MYI chair. A new Memphis program called "Adopt-A-School" has received national recognition as a model for business-education partnerships.

IBM donated $1.7 million in computer equipment, educational software, and training programs to five city schools as part of the Free the Children project. The IBM grant is for a three-year education project. Free the Children is a non-profit County-City initiative launched in 1988 to help children living in poverty through social service assistance to families and to encourage high school students to take the courses they need in preparation for college. As part of the project, Northside High School is initiating a program to actively integrate computers into the curriculum.

The Memphis Urban League's two-year old education initiative program works with low-income families to motivate children who were previously "turned off" to education. Program goals include setting up basic academic skills sessions citywide with emphasis on self-esteem, discipline, and self-confidence.

Memphis real estate developer Avron Fogelman funded a program, begun in 1987, to provide needy students with four-year scholarships to Memphis State University. The annual scholarships have a value of $1,300. In order to remain eligible, students must meet civic and citizenship requirements and maintain a 2.75 grade point average.

Two Memphis elementary schools will provide parents with recorded telephone information about school activities, lunch menus, scheduling changes, and homework assignments. BellSouth Corporation of Atlanta is testing a voice-messaging system called ClassNotes in two schools. Because BellSouth Corporation had installed the $50,000,000 in fiber optic telecommunication services and technology necessary for use of the system, Memphis was chosen as a test site.

**State Support of Education Initiatives**

The State of Tennessee began an educational reform program in 1984. The State Board of Education is requiring all school systems in the state to draft a plan that includes a mission statement with goals and objectives for the next five years. The percentage of 9th-grade students who have passed the Tennessee Proficiency Test has remained fairly constant. In 1989, 90 percent of the state's 9th-grade students taking the test passed the mathematics portion. In 1985, 89 percent passed this portion of the test. A decline in mathematics scores by 8th-graders was noted after the introduction of some prealgebraic concepts in the test. The Tennessee Comprehensive Assessment Program, begun in the spring of 1990, replaces two tests previously administered with one that will provide a comparison to national scores and chart individual students' progress.

Governor Ned McWherter, who has developed his 21st Century Classroom education reform plan, would like to see per-pupil spending reach $3,800 annually and teacher salaries become the largest in the Southeast. The governor has made education "restructuring" a main goal during his administration. The first phase of his program, school deregulation, will be instituted in seven Memphis schools in the fall of 1990. Deregulated schools will become autonomous under the provisions of the program.

In an effort to combat high Tennessee dropout rates, the governor is considering a proposal to confiscate the drivers' licenses of those students who obtain them and subsequently drop out of school. The proposal would include a provision to withhold a license for up to two years for youths convicted of alcohol or drug violations.

President George Bush held an education summit in Charlottesville, Virginia, with the nation's governors September 27-28, 1989. Prior to the summit, the National Governors Association issued an education report, highlighting state reform initiatives. The report calls for restructuring elementary and high school curriculums to emphasize problem solving. It also calls for states to link financial rewards and incentives to student performance while returning to teachers and principals the power to make classroom decisions on how to reach specific performance goals. Choice plans are President Bush's favorite means of educational reform but they are a problem for southern states, according to Tennessee Education Commissioner Charles Smith. Statewide choice plans in the South are hampered by race and poverty. States would have to pay to transport poor students between districts and could not upset court-ordered plans for desegregation. In Memphis a reform program within seven inner-city schools has been implemented, although the initial budget was cut. Administrators and teachers at the schools are receiving extra incentive pay. A lawsuit is anticipated in the near future challenging Tennessee's method of financing education.

The governors' report states further that from 1981 through 1987, classroom teachers' salaries rose 17 percent in the nation and 19 percent in Tennessee. Tennessee remains one of the few states that have passed a performance-based pay plan for teachers, which accounts for the higher salary percentile.

The report also surveyed the ratio of students to computers and reported that Tennessee has a 30:1 ratio, one of the highest ratios in the South.

Commissioner Charles Smith addressed a number of state education concerns for the press in September, 1989. He stated a need to restructure the whole system of education. He commented: "Over the years the emphasis has been prescriptive in nature in state and federal regulations. We ought to move away from that approach and look at outcomes and accountability. The Focused Instructional Program (FIP) in Memphis is an example. The city was able to do that because Dr. Herenton sought relief from state regulations to allow FIP schools to put more emphasis on teaching and math. . . .we gave them that opportunity. We're going to lose about 40 percent of the present teaching force by 1995. This is one reason the governor and I have made enhancing the teaching profession a top priority . . . I think to a large degree our teacher education programs are still teaching for the students of a school that existed 25 years ago. . . .so we have to do a better job of reality training . . . some people feel the time has come for a fifth year in teacher education. I'm not ready to say that. . . .Give them a real world experience rather than an artificial experience."

In response to the identified educational needs of Tennessee, Commissioner Smith developed the Year 2000 Plan, unveiled in January, 1990. As part of his bid for re-election, Governor McWherter has vowed to make education his top priority. The governor has also made it a well-known fact that he was a high school dropout, although he is also a proclaimed millionaire.

The state budget proposal calls for a 4 percent pay raise for teachers, making a teacher's state salary minimum $18,585 a year. The 1990 proposal also includes $2,200,000 to prevent at-risk students from dropping out and $1,130,000,000 for higher education, a 6.5 increase over the 1989 figure.

In February, 1990, President Bush visited Tennessee and praised the state for taking a lead in science and mathematics education. In a speech on his arrival, he noted that 41 percent more high school students in the state are taking mathematics and science than five years ago. He also praised a newly announced program to accelerate teaching and learning in those fields. The President concluded, "You in Tennessee know that goals and high expectations work. I believe what worked for Tennessee will work for America."

## C. Development of the Collaborative

During the 1988-89 school year, the Memphis Urban League (MUL) continued to serve as the collaborative's funding agent, with Herman Ewing, chief executive officer of the League, as collaborative director. Mr. Ewing was responsible for coordinating the project's efforts with the Ford Foundation, the larger UMC community, the Memphis Board of Education, and consultants to MUMC. The MUMC budget during the year had to be approved by the Memphis Urban League Board. It was noted in the permanence proposal that the transfer of fiscal responsibility from the Memphis Urban League to the collaborative Governing Committee would begin in January, 1990. This was provided for by having the Governing Committee submit a quarterly budget to the MUL Board for approval. Upon approval, funds would be deposited into the collaborative's account. In fact, the transfer of funds was not resolved until April, 1990. The Memphis Urban Mathematics Collaborative receives financial support from the Memphis City Schools, five universities and community colleges, and approximately 22 local corporations, businesses, and public agencies. Seven additional businesses provide indirect support that may include the contribution of individuals' time and expertise, but not funding. Projects involving the school system are operated through the MCS Division of Ford Foundation Projects and Optional Schools.

During the 1989-90 school year, negotiations were begun to transfer the funding responsibilities of the collaborative to Memphis State University. This required the cooperation of the Memphis Urban League and the Memphis City Schools administration as well as the approval of EDC and the Ford Foundation. The transfer of the fiscal responsibility for the collaborative was completed in the summer of 1990, following the close of the reporting period covered by this report.

Nancy Gates, a Memphis mathematics teacher, continued to serve as collaborative coordinator, devoting 40 percent of her time to her position as coordinator and 60 percent to the teaching of three mathematics classes at White Station High School. Her total salary is paid by the school district. As coordinator, Ms. Gates is responsible for implementing program objectives as specified by the Advisory Committee; coordinating the activities of the various committees; supervising the collaborative staff; and serving as a liaison between the collaborative, the Memphis City Schools, and the Memphis Urban League.

She also serves on the UMC Standing Committee, which met for the first time in May, 1989.

Anne White continued as the full time associate coordinator. Ms. White is responsible for office operations, the Teacher Internship Program, the Speakers Bureau, the collaborative newsletter, and the development of outside funding sources. In September, 1989, the Governing Board voted to increase her salary to better reflect the level of responsibility and time commitment involved, but this decision was not implemented by the MUL Board until May, 1990. The collaborative office was located at White Station High School in a room adjoining the classroom where Ms. Gates teaches, as it has been since September, 1988.

In the Memphis City Schools, all of the approximately 350 secondary mathematics teachers from the 53 schools with students in grades 7-12 are eligible to become members of the Memphis Urban Mathematics Collaborative. To become a member, a teacher simply needs to complete a form at the beginning of the school year indicating a desire to belong. In the 1989-1990 school year, 200 secondary mathematics teachers joined the collaborative, a decrease over the 275 registered secondary teachers for the 1988-1989 school year. In addition, teachers were invited to join the collaborative from eight elementary schools selected by the Governing Committee. Four were optional schools (Swowden, Idlewild, Peabody, and Sherwood) and four were non-optional (Dunbar, Manor Lake, Gordon, and Caldwell). Of the over 200 teachers from these eight schools, 150 were members of the collaborative. It is estimated that attendance in collaborative activities during the 1989-90 school year totaled over 400 participants. This was a significant increase over the number who participated in collaborative activities during the 1988-1989 school year. An estimated 50 secondary mathematics teachers and 35 elementary teachers are very active in collaborative activities.

The collaborative also invites private, parochial, and county schools to attend selected activities, conferences, and dinner symposia. The district grants two more staff development days each semester to collaborative secondary teachers and two annually for elementary teachers than it does to the rest of the faculty. The teachers who registered to join, the resource people from local higher education and business who serve on the Governing Committee, and a few persons from the district administration comprised the collaborative membership during 1989-1990.

## Think Tank

The final meeting of the Think Tank was held on August 15, 1989, at the Board of Education building. This meeting was held after the collaborative had received word that the Ford Foundation had approved its permanence proposal. Twenty members of the group met to select the people who would serve on the Governing Committee and to nominate 10 teachers to serve on the Operating Committee. Seventeen of the 18 people at the meeting, besides the 2 coordinators, agreed to be members of the Governing Committee. Four of the teachers agreed to be on the Operating Committee. Names were suggested to fill the other positions on both the Governing Committee and the Operating Committee. Later during the year, the size of the Operating Committee was set at eight in order to reach an appropriate balance, to accommodate all of the teachers who agreed to serve, and to include those who received district approval.

## Governing Committee

The Memphis Urban Mathematics Collaborative's permanence proposal to the Ford Foundation described the new governing structure for the collaborative. The Memphis Urban League Board agreed to transfer the policymaking responsibility for program activities to a Governing Committee. The guidelines for this transition indicated that all agreements previously made between the MUL and other organizations (Memphis City Schools, the Ford Foundation, and government bodies) and the policies of the MUL had to be upheld. Exceptions could only be made by prior written agreement. Also, no fiscal functions could be changed without the specific approval of the Memphis Urban League Board and then only for a specified period of time. Under these provisions, the governance of the collaborative is the responsibility of the Governing Committee consisting of no more than 25 members, including 5 business representatives, 5 college representatives, 11 teachers (one of whom is the Operating Committee chairperson), the director of the Division of Ford Foundation Projects and Optional Schools, the mathematics curriculum coordinator, the deputy superintendent of the Memphis City Schools, and the chief executive officer of the Memphis Urban League. The project coordinator and associate coordinator serve as secretaries to the Governing Committee. Meetings of the Governing Committee are held monthly during the year.

The Governing Committee has two major responsibilities. One is to be the primary decision-making body for the collaborative, within the conditions specified above. The Committee's other main responsibility is to generate funds from business and industry to support collaborative projects.

In August, 1989, 25 people were appointed to the Governing Committee: 11 teachers, 6 from higher education, 4 from business, 3 from the school district's administration, and the chief executive officer of the Memphis Urban League. At the Committee's first meeting in September, members drew slips designating their terms of office--one, two, or three years. Only the teachers, business representatives, and members from higher education participated in the drawing. The school district administrators and MUL administrator are considered permanent members of the committee. Eight of the 21 members drew one-year terms, seven drew two-year terms, and six three-year terms. The two coordinators and the on-site observer attended the meetings in addition to the regular committee members.

Ten meetings of the Governing Committee were held during the school year, from September through June. Attendance at the meetings ranged from 21 in September and March to 11 in June. The average attendance at meetings was 16, with from 8 to 10 teachers, 2 to 3 business representatives, 1 to 2 higher education representatives, a school district administrator, the collaborative director, and the 2 collaborative coordinators in attendance. Lana Soloman, a mathematics teacher at Sheffield High School, was elected chair of the Committee at the September meeting. Jackie Knight, a mathematics teacher at White Station Junior High School, was elected collaborative treasurer at the same meeting. A fiscal committee, comprised of four Governing Committee members, was appointed to work with Ms. Knight.

Time was spent at each Governing Committee meeting updating members on past and future collaborative activities. At some meetings, a presenter gave Committee members a demonstration of some area of teaching. In January, the Committee met at Idlewild Elementary School where the group visited one kindergarten classroom and one first-grade classroom and observed the use of "Math Their Way" teaching techniques. At the Committee's April meeting, held at Northside High School, James Kindred from IBM demonstrated the IBM's *Mathematics Exploration Toolkit* software. At another meeting, the committee visited Sandra Halfacre's class at Overton High School for a demonstration of graphing calculators. Other meetings were held at colleges, the IBM office building, and district high schools.

A part of the Committee's time during the year was spent on procedures or issues related to the operations of the Committee and the MUMC staff. Fiscal matters, which included resolving the issue of how money would be handled, consumed some time. In November, a plan was drawn up for transferring financial control of the collaborative from the Memphis Urban League Board to the Governing Committee by February 1. This did not take place--and authority to spend collaborative funds remained primarily with the MUL Board throughout the year. The collaborative treasurer, Ms. Knight, worked through the MUL and its board to have bills paid. Efforts were made during the year to put some funds into an account that the collaborative treasurer could draw from with the approval of the Governing Committee. At one time during the year, as much as $11,000 was to be put into this account; in March, 1990, $3,000 was put into the account so that the treasurer would have the resources to fund activities. In September, 1989, at its first meeting, the Governing Committee voted to increase the associate coordinator's salary to better reflect the amount of time she was devoting to the collaborative and the nature of her responsibility. In May, 1990, this request finally received the official approval of the MUL Board and was made retroactive from September. Also at the March meeting, travel grants to teachers to enable them to attend the NCTM Annual Meeting in Salt Lake City and the regional meeting in Chattanooga were voted on by the Committee, but had to be finalized by the MUL Board.

Other procedural issues were addressed by the Governing Committee during the year. In November, Velma Hodges, a mathematics teacher at Wooddale Junior High School, was elected chair of the Operating Committee. In December, it was decided that issues for discussion and approval by the Governing Committee should be submitted in writing for inclusion on the agenda. At the April meeting, the group decided to form a Nominating Committee to suggest names for replacing the Governing Committee members whose terms expired at the end of the school year. The Nominating Committee identified seven people who agreed to serve a three-year term on the Governing Committee. This slate of nominees was accepted in May and all were elected to serve on the Committee.

Another key issue addressed by the Governing Committee was that of making a change in the host agency. The work of the Committee on this is discussed below.

Some ad hoc committees were created during the year to address specific needs in governing the collaborative. The fiscal committee was formed in September and met in September, November, and January to track the allocation of funds. This group consisted of two teachers, the associate coordinator, one business representative, and one higher education representative. Financial statements were distributed at most of the Governing Committee meetings. An ad hoc task force was organized to consider the transfer of the collaborative to another host agency. This task force also noted the need for increasing publicity regarding the collaborative's work and made suggestions for running articles in existing community and district publications and for developing a collaborative brochure. The work of the ad hoc Nominating Committee was noted above.

## Operating Committee

The Operating Committee is composed of the two coordinators and eight teachers who are expected to work 133 hours per school year (in fulfillment of Career Ladder II and III requirements) to help identify, plan, and coordinate activities. This group assists in making decisions for the collaborative in the areas of mathematics education and school based reforms. It also helps determine what mathematics education issues the collaborative should address and makes recommendations to the Governing Committee. In 1989-90, small groups from the Operating Committee planned, organized, and coordinated project activities. The chairperson of the Operating Committee was initially appointed to a one-year term by the Think Tank Committee. The chairperson becomes chair of the Governing Committee the succeeding year.

The Committee met with the two coordinators on October 31, 1989, to discuss the group's organization and working requirements. It was noted that the 133 Career Ladder hours could be served preparing the collaborative newsletter, planning and coordinating inservices, planning an equity conference, or attending to other office work. It was decided that members of the Committee would sign up to work on specific days of the week to pursue what they chose to work on in support of collaborative activities. On November 17, the Operating Committee again met as a group to discuss with Janet

Daisley, Education Development Center (EDC), prospects for writing proposals, including an application for one of EDC's Outreach grants. Three teachers in the group who chose to work on writing proposals met, after the meeting with Ms. Daisley, for a brainstorming session.

The next meeting of the Committee was held on December 4, when the group brainstormed ideas for spring activities. Some of the suggestions included one-day sessions on topics such as mathematics clubs, student projects, or preparing for mathematics contests, and afternoon sessions on cooperative learning and manipulatives. At a meeting on January 18, 1990, the group received new guidelines for signing up for collaborative-oriented Career Ladder credits. Future workshops were discussed and the teachers were asked to recommend the names of colleagues to attend the March NCTM regional meeting in Chattanooga. The importance for the future of the collaborative in writing proposals and receiving grants was emphasized at the meeting.

The final meeting-of-the-whole for the year was held on April 23, 1990. By this time the teachers were given responsibilities in one or more of six areas: written communications, membership and attendance maintenance, fund raising, teacher contact, financial tracking, and materials management. A set of guidelines was prepared indicating that the areas of concentration for the group included, but were not limited to, setting high expectations for minority and female students; enhancing the present curriculum for high-achieving students; developing teaching approaches that encourage student advancement from arithmetic courses; and integrating technology into the curriculum on every level so that all students will be better equipped to enter the work force. The guidelines listed (1) nine program activities for the 1989-90 school year and (2) the procedures the teachers needed to fulfill their Career Ladder responsibilities, including a minimum of 20 hours to be served during the summer months.

## Transition to Memphis State University

In July, 1989, the Ford Foundation approved the Memphis Urban Mathematics Collaborative's proposal for permanence for a three-year period. It was agreed that 29 percent of the funds would be issued for each of the first two school years (1989-90 and 1990-91), and the remaining 42 percent of the funds would be released for the third year.

Monies from the collaborative's Contingency Fund was to be used in each of the first two years so that the annual level of funding will be nearly the same during each of the three years. The permanence proposal noted that the intent of the collaborative was to continue under the Memphis Urban League as its host agency for a period of two years and then file for non-profit status to become a self-supporting organization. The Ford Foundation's project monitor questioned this and wondered if other possibilities had been considered such as affiliating with a local university or college. The response was that by January, 1990, a task force composed of Governing Committee members would examine possibilities such as colleges, universities, business, public non-profit organizations, or any other plausible organization that could serve as a permanent host organization. Memphis City Schools was among the organizations under consideration at the time.

During the 1989-90 school year, the different possibilities were explored. In January, 1990, Memphis State University was approached about the possibility of hosting the collaborative. At the March Governing Committee meeting, an update of the work of finding a host agency was provided. Nancy Gates reported that Memphis State University had indicated it was interested in housing the collaborative and that both Superintendent Herenton and Linda Sklar, director of The Division of Ford Foundation Projects and Optional Schools for MPS, were in favor of this change. The committee requested that the associate coordinator prepare a proposal, with its rationale, to discuss and act upon at the April committee meeting. Herman Ewing, of the Memphis Urban League, was to contact the Ford Foundation to get its reaction to such an action. In April, the Governing Committee approved a motion to submit a rationale to the Ford Foundation for the transfer of the collaborative from the Memphis Urban League as host agency to Memphis State University and to continue discussions with MSU in specifying a transfer plan. The Committee was informed at its May 17 meeting that Mark Driscoll, EDC, and Barbara Scott Nelson, Ford Foundation, requested that they be sent a specific proposal specifying why a new host agency for the collaborative would be beneficial. Members of the Committee were each asked to write a few sentences explaining the pros and cons for taking this step. On May 30, 1990, a proposal to shift the host agency responsibilities from the Memphis Urban League to Memphis State University was sent to EDC. By the end of June, 1990, no word had been received from EDC. However, Nancy Gates had talked with Barbara Scott Nelson who had said that she did not foresee a problem with MUMC relocating at Memphis State University. September 1, 1990, was tentatively set as the date for the transfer to become effective.

## D. Project Activities

During 1989-90, the Memphis Urban Mathematics Collaborative sponsored a variety of activities for elementary and secondary mathematics teachers. The activities were designed to promote teacher professionalism, to establish linkages between Memphis mathematics teachers and other mathematics professionals in business and higher education, and to enable teachers to keep abreast of developments in the fields of mathematics and teaching. The collaborative also supported teachers' attendance at national and regional conferences and institutes.

### Summer 1989 *Geometric Supposer* Workshop

The Memphis collaborative sponsored a workshop on the *Geometric Supposer* software on July 27, 1989, from 8:30 a.m. to 3 p.m. at the Professional Development Center at East High School in Memphis. The one-day workshop, conducted by MUMC teachers Nancy Goodwin of White Station High School and Bernice Gailey of Whitehaven High School, provided hands-on training on the *Geometric Supposer*. This software actively involves students in the exploration of geometric relationships and encourages them to participate in the conjecturing process and in the discovery of theorems, working in a small-group learning environment.

The workshop was designed for geometry teachers interested in using the software package during the 1989-90 school year. While space was available for 20 participants, only 11 teachers registered. The low attendance was attributed to the fact that the workshop was held during summer vacation. The 11 participants received a $40 stipend.

The teachers were enthusiastic about all aspects of the workshop. Seven of the eight participants who completed written evaluation forms rated all aspects of the workshop a 4 or 5 on a 5-point scale (with 5 being the highest). The eighth participant rated all areas of the workshop a 5, with the exception of his or her own participation, which was rated a 3. Comments from participating teachers were very favorable. One teacher wrote, "All math teachers should be exposed to this software." A second teacher remarked, "Need to know how to procure the *Supposer* for my own school." The on-site observer reported, "All evaluations were very positive! The only concern was getting funds in order to buy the software."

## Professional Growth Credit Fall Workshop Series

The Memphis Urban Mathematics Collaborative sponsored a fall afternoon workshop series to provide teachers with an alternate way of earning professional growth credit. Each afternoon session was worth two hours of professional growth credit, which could be applied to the six hours of credit needed to be excused from the March 16 citywide inservice day. Teachers also had the option of receiving SACS (Southern Association of Colleges and Schools) credit instead of professional growth credit. Advance registration was required in order to receive credit. All of the workshops were led by teachers, whose presentations consisted of information they had obtained from summer workshops.

The collaborative offered two separate series of workshops, one for secondary teachers and one for elementary teachers. Both workshop series were very successful, with 41 secondary teachers, 73 elementary school teachers, and 24 non-collaborative teachers participating in at least one of the sessions. The teachers seemed to appreciate having an alternate way to earn professional growth hours. One participant remarked, "It's more enjoyable attending a session you're interested in rather than one you must attend just to fulfill hours."

### Secondary Workshop Series

Five afternoon sessions on Geometry, Graphing Calculators, Probability and Statistics, and Patterning for Arithmetic were presented during the Secondary Fall Workshop Series. Each workshop ran from 3:15 p.m. to 5:15 p.m., with the location of the workshops varying depending on the presenter.

Highlights of the Woodrow Wilson Institute on Geometry. The first workshop in the Secondary Workshop Series was held on October 24, 1989, at Christian Brothers College. The workshop addressed topics including the role of coordinates, transformations, and proofs in today's geometry. During the session, which was led by secondary school mathematics teacher Christa Warner, a discussion was held on new approaches to teaching age-old geometry as presented at the Woodrow Wilson Institute held during the summer of 1988. One of the approaches emphasized the student's own discovery of geometry concepts by investigation. Nineteen teachers, representing 12 junior high and high schools, participated in the workshop. In general, the participants felt that the workshop was helpful, with the majority of teachers rating the workshop 4 or 5 on a 5-point scale (with 5 being highest) for clarity of goals, effectiveness of the methods used in the workshop, the helpfulness of the instructors, and the usefulness of the session.

Graphing Calculators for Precalculus. The second workshop, which was held on November 2 at Overton High School, focused on topics from the Ohio State University Calculator and Computer PreCalculus Project. The workshop was presented by Sandra Halfacre, who had participated in a conference on the Calculator and Computer PreCalculus Project ($C^2PC$) during summer, 1989. The project, which is designed to strengthen students' understanding of mathematics and increase the portion of college freshmen prepared to begin their collegiate mathematics study with calculus or its equivalent, stresses a highly geometric approach to problem solving and precalculus mathematics. Sixteen teachers, representing 12 junior and senior high schools, participated. The teachers seemed to find the workshop worthwhile, with several teachers commenting that they particularly enjoyed the student helpers who had participated in the session. On the written evaluation forms, the majority of teachers rated the workshop 4 or 5 on a 5-point scale for the effectiveness of the methods used during the workshop, the helpfulness of the instructors, their own participation, and the likelihood they would recommend the workshop to other teachers.

Experimental Probability and Statistics. The third workshop in the series was presented on November 9, at Christian Brothers College. The workshop was led by teacher Donna Porter and associate collaborative coordinator Anne White, both of whom had attended the Illinois Institute of Statistics Education during the summer of 1989. The workshop discussion focused on the five-step procedure for solving probabilistic and statistical problems that had been presented at the Illinois Institute. The workshop was attended by 11 teachers, representing 8 junior and senior high schools. All of the teachers seemed to find the workshop very valuable, with all but one teacher rating all aspects of the workshop as either a 4 or 5 on a 5-point scale. The teachers seemed to enjoy themselves during the workshop. Comments on the written evaluation forms included, "Small group was good. Great! Fun!" and "Hands on activities are fun!"

Patterning for Arithmetic and Applied Mathematics. This workshop, which was held on November 13 at State Technical Institute, focused on the study of patterns and how to teach students to generalize number patterns to model, represent, or describe observed physical patterns, regularities, and problems. The workshop, which was led by copresenters Margie Hobbs and Cheryl Cleaves, was attended by 14 teachers, representing 8 junior and senior high schools. The teachers rated the workshop very highly, with all but two participants rating the workshop a 4 or 5 in all areas.

Highlights of the Woodrow Wilson Institute on Functions. The last workshop in the Secondary Workshop Series was held on November 14 at East High School. The session, which focused on the highlights of the Woodrow Wilson Institute on Functions, addressed three themes: the teaching of traditional topics in new and exciting ways; the teaching of previously inaccessible topics, now made possible by new technology; and the technology itself--calculators, computers and powerful software. The workshop, which was led by Causaundra Bradley and Donna Porter, was designed primarily for teachers of Algebra I and higher level mathematics courses who have had prior experience with computers. The workshop was attended by 12 senior high school teachers, representing 8 schools. The participants rated the workshop extremely high on the written evaluation forms. All but two teachers rated every aspect of the workshop either a 4 or 5 on a 5-point scale. The two teachers who gave lower ratings based them on the usefulness of the workshop, and one commented that his/her mathematics department did not have computers.

## Elementary Workshop Series

To meet the needs of elementary school teachers, the newest MUMC members, the collaborative offered three Mathematics Made Meaningful workshops on October 26, November 6, and November 13. The Mathematics Made Meaningful program is a holistic approach to critical thinking skills in mathematics. The program stresses estimation, pattern recognition, data analysis, and locating mathematics in everyday life. The workshops, which were held at Idlewild Elementary School, were designed to promote teaching styles and strategies that emphasized active-learning experiences, problem-solving skills, and independent investigation. During the workshops, the elementary teacher presenters, Patti Scanlon, Sandy Stubblefield, and Betty Buchignani, discussed methods of actively involving students in their own learning through discussion and writing about mathematics and through the use of manipulatives and other concrete experiences that help students internalize and understand mathematics. While the main emphasis of the workshop was on incorporating these teaching styles into instruction at all grade levels, the presentation was made primarily from a K-3 viewpoint. All three workshops were extremely well-attended, with 34 teachers at the first workshop, 38 at the second workshop, and 46 at the third.

The teachers seemed to greatly enjoy and appreciate the workshop. The majority of the participants rated all aspects of the workshops a 5 on a 5-point scale. Comments on the written evaluation forms included: "A fun inservice"; "Compliments to the facilitators. They were well prepared"; "Great"; "This was a very enjoyable workshop. A lot of good ideas"; "Wonderful, informative"; and "Loved the hands-on." The on-site observer reported, "I attended one elementary workshop--it was wonderful! Teachers did hands-on activities and were really excited about what they were learning. Elementary teachers are eager to improve their math teaching skills."

## Grant Writing Workshops

### December 5 Workshop

The collaborative sponsored a workshop on grant writing on December 5, 1989, from 8:30 a.m.-3:30 p.m. at Christian Brothers College. The workshop was offered in response to teachers' requests to attend a workshop like the one the collaborative had sponsored in March, 1988. The workshop was presented by Brother Edward Doody and Dr. Emily Mathis, Department of Grants and Proposals at Christian Brothers College. All components of grant development were covered in the workshop, including tips for writing grant proposals, for researching available grants, and for developing program objectives, including an appropriate budget and timetable. In addition, the booklet distributed in the 1988 workshop was revised.

Although an open invitation to attend the workshop was extended to all MUMC members, participation was limited to the first 35 applicants. The Memphis City Schools provided release time to enable teachers to attend the workshop.

The participants, which included elementary, middle, and high school teachers, evaluated the workshop very favorably with most rating it a 1 or 2 on a 4-point scale (with 1 being the highest). One teacher commented, "This workshop really served its purpose! Teachers were excited about the workshop sessions and felt they learned important ideas needed in writing grants." A second teacher wrote, "Elementary teachers were really appreciative. They received a really good view of MUMC and felt good about what they were learning!" A third teacher said, "This was outstanding. It was the quintessential workshop on grant writing. . . .I can use everything I learned." The on-site observer reported, "Comments were extremely positive. Teachers felt they learned many concrete ideas that they needed in order to apply for available grant funds."

### February 9 Workshop

The response to the December Grant Writing Workshop was so great that, to accommodate teachers who were not able to attend, a second Grant Writing Workshop conducted by Brother Edward Doody and Dr. Emily Mathis was scheduled for February 9. Twenty-two collaborative teachers, which included an equal representation of secondary and elementary school teachers, participated in the workshop.

As with the first workshop, participants evaluated the workshop very favorably, with all but one participant rating it a 4 or 5 on a 5-point scale (with 5 being the highest). Comments on the evaluation forms were also very positive and several teachers requested a follow-up workshop. One teacher wrote, "How would it be to have a follow-up workshop where you bring materials and ideas to actually write a proposal to use? This would allow the experts to help critique as we go along. Thanks for providing the workshop. It was great!"

## Family Math Night

Family Math Night, a project sponsored by the Memphis Collaborative, was held at Idlewild Elementary School on February 12, 1990, from 6:30 to 8 p.m. The parents and students of Patti Scanlon's kindergarten and Sandy Stubblefield's 1st-grade classes were invited to participate. Betty Buchignani, another collaborative teacher, assisted with the open house.

The goal of this family-oriented program was to teach parents how to provide their children with meaningful concrete experiences that build a true understanding of the mathematics patterns, language, and symbols needed to perform numerical operations. For the first 15 minutes, parents learned about their child's mathematics program. Then, the families, under teacher guidance, worked together on patterning concepts using the same manipulatives that the children use daily in the classroom. The finished product was a "patterned quilt" which was displayed in the school's hallway.

The teachers reported that the evening was a huge success, with over 40 families participating in the program. The on-site observer reported, "Parents were quite impressed! Parents wanted to do this monthly! Children asked if they could do it again 'tomorrow'! It was great PR and a great way of showing parents new math education techniques. A great success."

## Woodrow Wilson Institute Follow-Up Session

A follow-up session for participants of the Woodrow Wilson National Fellowship Foundation Institute on the Effects of Technology in Mathematics, which the collaborative had sponsored in June, 1989, was held Saturday, February 24, 1990, at Rhodes College in Memphis. The follow-up session is considered an integral part of the Woodrow Wilson program and each teacher was strongly urged to attend and to bring another mathematician. Eleven of the 25 Woodrow Wilson participants attended the meeting, which began at 10 a.m. and concluded at 1 p.m., followed by a lunch at Ruby Tuesday's.

The purpose of the follow-up program was to provide an opportunity for Institute participants to share ways they have implemented ideas from the Institute into the classroom, share new ideas they have developed for their classes, and hear the successes or problems others have encountered. Dr. JoAnn Lutz, department head of Mathematics and Computer Science at the North Carolina School of Science and Mathematics and one of the four Master Teachers who had conducted the Institute in June, led the discussion. She worked the "Michael Jordan" problem, a linear programming problem, and demonstrated the IBM *Toolkit* software. Teachers felt that the follow-up session was worthwhile and provided good sharing.

### "Hands-On Equations" Workshop

On March 17, 1990, MUMC sponsored a half-day workshop, "Hands-On Equations," to introduce teachers to a hands-on, concrete approach to solving algebraic linear equations. The workshop, which was held from 9:30 a.m. to 12 noon at the Board of Education building, was presented by Dr. Henry Borenson, developer of the Hands-On Equations Learning System and a well-known educator from Dublin, Pennsylvania. The system, which utilizes a scale, playing pieces, and numbered dice to teach students how to solve algebra problems, is designed to give students in grades 4-6 a solid background in algebra.

The workshop was open to all teachers in the area, although non-collaborative teachers had to pay a $15 registration fee. This was the first time that MUMC collected fees from non-members. SACS (Southern Association of Colleges and Schools) credit was available and all workshop participants were entered in a drawing to receive a Hands-On Equation kit, which included manuals, worksheets, and a student set of game pieces. Forty-two teachers attended the workshop, including 25 collaborative teachers, 16 non-collaborative teachers, and the collaborative coordinator. Participants included secondary as well as elementary school teachers. Two local television stations reported on the workshop.

The teachers' reactions to the workshop were extremely positive, with most of the participants rating the workshop a 4 or 5 on a 5-point scale (with 5 being the highest). One teacher wrote, "Finally I've discovered something exciting and new for my accelerated third graders, something other than just extended lessons and something those students can go ahead with." Another commented, "The goals were good for 5th-12th grades." A third teacher said, "Excellent presentation!" A fourth teacher wrote, "I would like an all-day workshop." One teacher inquired, "Are funds going to be available for purchase of these materials?" The on-site observer reported, "Evaluations were consistently high. Several teachers wanted more time, all day sessions. Many said they would like the kits that were demonstrated!"

## Dinner Symposium

A dinner symposium for the Memphis Urban Mathematics Collaborative Governing Board and selected guests was held at the Peabody Hotel on Wednesday, March 28, 1990, from 4:30 to 7 p.m. The symposium, which focused on mathematics as communication for minority students, was planned by the collaborative and co-sponsored by the Miami Desegregation Center in coordination with the Memphis City Schools' Federal and State Projects Department. Gilberto J. Cuevas, director of the Fellows for the Advancement of Mathematics Education Program at the University of Miami, led working sessions addressing mathematics as communication and the interrelationship between the NCTM *Standards*, teacher leadership, and the *Professional Standards for Teaching Mathematics* currently being developed by NCTM. Attendance at the event was very high; 27 of the 33 people who had been invited attended. The 27 participants included 14 collaborative teachers, 1 non-collaborative teacher, the collaborative director and the 2 coordinators, 2 school administrators, 3 representatives from business, and 4 from higher education.

The response to the event was extremely enthusiastic. One teacher said, "I wasn't too sure about this following a day at school, but Dr. Cuevas was entertaining as well as informative. His voice was even pleasant! The meal was delicious and I enjoyed the camaraderie." A second teacher commented, "Worthwhile evening. I plan to use some of these communication examples in my classes. He is right--we need to teach students how to communicate mathematically." A third teacher remarked, "I'm glad I attended. I learned some new ideas from the speaker. The dinner was great and gave me time with people I only get to see once a month." A representative from business added, "This is really nice. I enjoyed his examples about communication." A professor noted, "Wonderful afternoon. I enjoyed his presentation. This is a wonderful meal. It is nice to have a dinner meeting like this sometimes." The on-site observer reported, "Wonderful afternoon session! Participants really 'got into' group illustrations. Dr. Cuevas was interesting as well as entertaining. Meal was terrific and provided great sharing time."

## IBM Technology Conference and Dinner

MUMC and IBM cosponsored a second IBM Technology Conference for teachers on April 5, 1990, from 4 to 8 p.m. at the IBM Customer Center in Memphis. The conference was designed to expose teachers to the latest in technology and to make them aware of how computers and graphic calculators can be incorporated into their curriculums. The conference began with introductory remarks, followed by a 45-minute session on calculators conducted by Memphis teachers. Sandra Halfacre and Virgie Cox led the secondary session and Kathleen Cousins conducted the elementary session. After dinner, from 6 to 8 p.m., IBM mathematics specialists conducted sessions on computers. The session for secondary teachers was presented by IBM representative Irwin Hoffman and the session for elementary teachers was presented by IBM representative Debbie Gunn.

All MUMC members were invited to attend, with enrollment on a first come-first serve basis until registration was full. There was an overwhelming response to the event, and within a few days both the elementary and secondary sessions were full, and a waiting list created. Sixty-seven collaborative teachers, as well as the two collaborative coordinators, attended the event. Participants received four hours of Southern Association of Colleges and Schools (SACS) credit as well as the complimentary dinner.

In general, reactions to the event were extremely positive with both secondary and elementary teachers finding the conference worthwhile. A secondary teacher said, "I enjoyed the whole evening. The meal was good. Sandra's students who demonstrated the graphics calculators were quite good! The speaker was so knowledgeable." Another secondary teacher remarked, "This is really nice. You don't mind coming to something like this on a school night even. I wish I had access to the calculators or the IBMs." An elementary teacher commented, "I thought it was good. Kathleen Cousins discussed calculators, gave us a good handout, and allowed some hands-on work. The computer presenter seemed redundant at times. Pacing could have been better; for instance, stagger the dinner times. We lost time in line there. Overall, it was good. I learned and it's great to have these opportunities." Another elementary teacher added, "Computer teacher was not good at all. . . .She continued talking even though the teachers could not see the material. The calculator session went well." A third elementary teacher said, "I really thought it was fantastic! We don't have the manipulatives, calculators, and computers we need. The Board needs to provide us with more of the resources we need. We need more workshops like these. They help us to teach children to think critically. I thought the whole evening was very worthwhile." The on-site observer reported, "Irwin Hoffman was dynamic. I wanted to jump in and try his software the next day, but no IBM's are available. He does make you want to work towards the discovery approach with students!"

## IBM Mathematics Software Seminars

MUMC and IBM cosponsored two two and one half-day seminars on the use of mathematics software, one seminar on algebra and one on geometry. The seminars were held at Northside High School June 4-6, with each seminar running a total of 15 hours over the three days. The purpose of the seminars was to instruct teachers on IBM software so they will be able to help other teachers integrate the software programs into the curriculum. Both seminars included an introduction to *CALC*, a software program that encourages mathematical thinking. The algebra sessions were conducted by IBM mathematics specialist Irwin Hoffman and the geometry sessions were conducted by IBM mathematics specialist Diane Kussatz.

The sessions were open to all MUMC teachers on a first come-first serve basis. Due to the large number of responses, several teachers who had applied were not able to attend. The seminars were attended by 36 participants, including 25 collaborative-supported teachers, the collaborative coordinator, and 10 teachers supported by Ann Erickson of the MCS Microcomputer Division. Ms. Erickson had been instrumental in organizing the conference, along with collaborative Coordinator Nancy Gates and Irwin Hoffman. Teachers who participated received six hours of Memphis City Schools Optional Inservice Credit for attending the first day, called Session One. For attending the next day and a half, Session Two, collaborative-supported teachers received a $60 stipend. Teachers were expected to attend both sessions.

The response to the seminars was extremely favorable, with most of the participants rating all aspects of the workshop a 4 or 5 on a 5-point scale (with 5 being the highest). The primary concern that teachers expressed was the lack of access to IBM computers in their schools, although several teachers also expressed a need for more time during the seminars. Written comments on the evaluation forms for the algebra seminar included, "More time needed so that all of us could better understand how to use the software. Excellent workshop. I wish only that follow-up workshops be organized so that we do not forget how this can be done in our classroom"; "More time writing lesson plans and working together with other teachers;" "Very good and helpful;" "It would be much more helpful if I had a room full of IBM computers"; and "Do not have IBM computers. All mathematics teachers should have the opportunity to use this software."

Comments on the written evaluation forms from the geometry seminar included: "Diane Kussatz is a super instructor! It really piques one's interest. Guarantee all participants follow the instructor step by step until independence is exhibited! Need the proper funding"; "Leader excellent and personable. Same format is fine. Need further practice"; "Especially useful if our PC juniors have memory upgraded to run IBM Geometry One and Two"; and "We don't have computers."

IBM has been generous to the collaborative by loaning a computer for use in the collaborative office and another one to Sandra Halfacre whose students gave a demonstration of the use of the *Toolkit*.

## Meaningful Mathematics Summer Workshop

MUMC sponsored a summer workshop course, "Meaningful Mathematics," at Christian Brothers College, 8 a.m. to 1 p.m., June 13-20, 1990. The workshop, which was for teachers of grades K-2, presented a theory on how children learn and how to develop useful problem-solving skills using concrete materials and real-life situations. The concepts covered included: patterning, sorting, classifying, comparing, graphing, counting, and numbers and place value. The course was also designed to help teachers implement the current NCTM *Standards* in primary mathematics programs.

Two sessions of the course were conducted, one by Janet Shew and one by Sharon McFarland, both of St. Louis, Missouri. Both women are experienced workshop leaders and classroom teachers of *Mathematics Their Way*. Participants in both sessions were actively involved in a model classroom setting. Three major resources were used for the course: *Mathematics Their Way, Developing Number Concepts Using Unifix Cubes*, and *Box It Or Bag It Mathematics*.

The course was open to all area teachers of grades K-2, although 30 spaces were reserved for collaborative teachers. Registration was limited to 35 participants for each session, for a total enrollment of 70. MUMC had planned to pay book fees and tuition for 30 collaborative teachers. In addition to the collaborative teachers, 40 non-collaborative teachers participated; in the end, a total of 68 attended the workshop. Participants had the option of paying an audit fee of $155 and receiving SACS credit, or paying $235 and receiving two hours of graduate credit from Lindenwood College in St. Louis, Missouri. An additional one hour of credit could be obtained by doing a special project and paying an additional $40.

The participants from both sessions were extremely enthusiastic about the workshop and the information presented. Most of the participants rated all aspects of the workshop a 5 on a 5-point scale. In the written comments on their evaluation, teachers requested a follow-up session and others suggested that the workshop be scheduled over a 5-day period with longer hours each day. Several teachers also expressed concern as to whether money would be available to purchase classroom materials. One teacher wrote, "It's been a thrilling week!! I'm very motivated and rejuvenated." Another said, "It was fantastic. . . .I am very interested in becoming involved with MUMC. . . ." A third teacher commented, "All teachers (parents) need this experience." A fourth teacher wrote, "It's so refreshing to have an instructor that is still in the classroom and knows what it is still like!" Another teacher said, "This workshop was very effective in helping me learn how to use materials I have and have never used." And a sixth teacher wrote, "Thanks to MUMC for helping pay for the workshop."

## Woodrow Wilson Institute on Mathematical Modeling

The Woodrow Wilson National Fellowship Foundation received a grant to present an Institute on Mathematics Modeling in Memphis June 18-22, 1990, at Rhodes College. The session was conducted by Master Teachers who had participated in a four-week Summer Institute on Mathematical Modeling held at Princeton University under the direction of the Woodrow Wilson National Fellowship Foundation. The three teacher-leaders were Gloria Barrett of North Carolina, Allan Bellman of Gaithersburg, Maryland, and David Daniels of Longmeadow, Massachusetts.

The primary focus of the Institute was mathematical modeling, which uses mathematics to describe real-world events and to solve actual problems. Examples were drawn from science, sports, management, engineering, and social science. The content enhances the mainstream secondary school curriculum from algebra through pre-calculus. The methods used employ graphs, tables, formulas, functions, and simulations. Whenever appropriate, calculators and computers were used as modeling tools. During the Institute, participants had opportunities to informally exchange information about mathematical content as well as pedagogical techniques and classroom management methods. The overall goal of the Institute was to demonstrate how modeling can become a comfortable part of each participant's curricular domain, with the result that the profession of teaching will be more interesting, effective, and current.

All MUMC teachers, as well as all mathematics teachers within a four-hour drive, were invited to enroll in the Institute. Registration for MUMC teachers was accepted on a first come-first serve basis, as the collaborative was willing to pay the tuition fee for 25 of its secondary teachers. Registration, however, was not filled, and only 22 teachers, including 13 collaborative teachers, the collaborative coordinator, and 8 non-collaborative teachers participated. Non-collaborative participants paid a fee of $125, which included lunch and coffee Monday through Friday and a reception Thursday evening, as well as Institute materials. IBM moved 12 computers from an MCS school to Rhodes College for the use of Institute participants.

The participants seemed to feel that the Institute was extremely worthwhile, with the majority of teachers rating the Institute a 5 on a 5-point scale. The only area in which the ratings fell was when attendees rated their own participation in the Institute. Even then, the ratings averaged nearly 4.2. For some teachers, this was their first Institute. Comments on the evaluation forms included, "I hope to continue to learn more about modeling and how to integrate it into my classroom"; "This was wonderful!"; and "Wish other teachers had attended too." Several teachers also requested that there be a follow-up session to discuss ideas that have been tried. The on-site observer reported, "This was a wonderful workshop! We all received examples of daily life situations where math modeling could be used. I received several items I plan to incorporate into my classes this fall. I highly recommend this Institute. The three instructors were extraordinary!"

## Outside Funding

### Transitional Arithmetic Institute Project

The collaborative and Memphis State University received a $30,000 grant from the Tennessee Higher Education Fund to support a one-week institute workshop for teams of arithmetic teachers. The focus of the project is to help high school mathematics teachers incorporate algebraic approaches into the teaching of arithmetic so that students in applied mathematics classes can make a better transition to Algebra I.

The grant proposal, which was prepared by Dr. Hugh McHenry of Memphis State University, collaborative associate coordinator Anne White and collaborative teachers Lana Solomon and Ty Legge, was submitted in September, 1989. The final decision on Title II funding was made by the Tennessee Higher Education Commission (THEC).

Using the funds from the grant, the Department of Mathematical Sciences at MSU and the MUMC will sponsor the Transitional Arithmetic Institute for Teachers in the summer of 1990. Twenty-five arithmetic teachers of grades 7-9 will attend the week-long Institute, which will be held August 6-10, at Memphis State University. The two main objectives of the Institute will be to provide an opportunity for teachers to develop new strategies and materials for the 1990-91 school year and to form teacher peer support groups that will serve as catalysts for further innovation in the teaching of arithmetic in the Memphis area. Key topics in transitional arithmetic will be the workshop focus, with the sessions covering arithmetic concepts that facilitate transition to higher level mathematics courses, including problem solving, applications, the use of calculators and computers, and effective teaching strategies.

## PROJECT MERGE+

Dr. James Robinson, a professor at LeMoyne-Owen College and a member of the MUMC Governing Committee, received a grant from the National Science Foundation for PROJECT MERGE+, a teacher development program in mathematics for teachers of grades 5-8. The project sponsored a fall 1989 evening course in algebra, a spring 1990 evening course in trigonometry, and a five-week summer workshop in mathematics emphasizing teaching methods. Participants will also have the opportunity to attend a one-week statistics and probability workshop and a two-day mathematics curriculum review workshop that will be coordinated by the Memphis Urban Mathematics Collaborative, through a subcontract under the NSF award.

Teachers who participated in PROJECT MERGE+ received a total of nine semester hours of tuition-free undergraduate mathematics credit offered on a credit or audit basis, with textbook provided. In addition, teachers received a $360 stipend for the fall 1989 course and a $360 stipend for the spring 1990 course; they will receive a $1,500 stipend for the five-week summer workshop. Stipends will also be awarded to teachers who attend the two MUMC workshops scheduled during summer, 1990.

## EDC Outreach Grant

MUMC was awarded a $5,000 grant from the Education Development Center (EDC) to enable the collaborative to study the development of strategies for addressing equity in mathematics education. Twenty 7th-grade teachers will be identified to work on developing and applying techniques to improve the performance of their students in mathematics. The teachers will participate in a one and one-half day session with Professor Arthur Powell of Rutgers during the fall of 1990 and then continue to meet during the 1990-91 school year.

## National and Regional Conferences and Institutes

MUMC sponsored teachers' attendance at a variety of national and regional conferences. The teachers were encouraged to bring back new ideas not only for themselves, but to share with other local teachers.

### Institute on Discrete Mathematics

Four MUMC teachers received collaborative funds to attend the Teachers Teaching Teachers Discrete Mathematics Institute held at the University of Northern Iowa--Cedar Falls, July 10-21, 1989. The three-week conference, which was sponsored by the Council of Presidential Awardees in Mathematics, was primarily for teachers of Algebra II and higher-level secondary mathematics courses. A variety of topics were addressed including problem-solving applications, critical thinking, and data analysis. MUMC had distributed information about the Institute to its members, and teachers who were interested applied to the Institute for admittance. Team participation was encouraged for applicants.

All four teachers felt that attending the Institute was a very positive experience. One teacher remarked, "It was worthwhile. It addressed many topics that can be used on several levels in junior and senior high mathematics classes. I am already using some of the materials in my classes." A second teacher said, "I was the only black male in attendance. It was great. I could share with other teachers and discovered we all have similar problems." A third teacher remarked, "I learned a lot. I worked hard but this 'meant a lot to me.' The accommodations were beautiful; food was wonderful." The fourth teacher added, "It is definitely worthwhile and if given a chance, someone from Memphis should attend next year."

### Illinois Institute for Statistics Education (IISE)

Two collaborative teachers and the collaborative's associate coordinator received funding from IISE to attend the 1989 Illinois Institute for Statistics Education in Champaign, Illinois, July 10-28, 1989. The Institute, designed for middle and high school teachers and district staff, was designed to promote and support the teaching of statistics and probability in middle and high schools. The workshops emphasized the central role of statistics in science, government, and industry, as well as in everyday life. A major thrust was instructional strategies for teaching students with a wide range of mathematical ability.

The Memphis team had been selected by IISE staff from among nationwide applicants. Candidates were selected on the basis of (1) qualifications of team members, (2) the school district's commitment to implementing statistics in the curriculum, and (3) the perceived ability of the team and its district to impact on state and national statistics reform.

The three MUMC members who participated reported that they had obtained a lot of new ideas. Two of the participants shared what they had learned with other Memphis teachers by presenting a session at the Fall Workshop Series. In addition, the two teachers who participated planned to teach six weeks of statistics, for the first time, in their mathematics classes during the 1989-90 school year.

## $C^2$PC Graphing Calculator Workshop

Sandra Halfacre's travel was paid for by the collaborative to attend the two-week $C^2$PC Graphing Calculator Workshop, held at Ohio State University, in Columbus. The workshop gave teachers information on a new course emphasizing application and graphing as a tool to build geometric intuition. The course is intended for high school juniors or seniors who have successfully completed Algebra I, Geometry, and Algebra II.

## Advanced Placement Calculus Institute

The Memphis Collaborative funded two teachers to attend the Advanced Placement (AP) Calculus Workshop held at the University of Alabama, Tuscaloosa, July 24-28, 1989. The conference, which was sponsored by College Board-AP Programs, was designed to update teachers on AP Calculus topics. Concepts were taught, new software and texts were discussed, and preparation for the AP exam was critiqued. All MUMC calculus teachers were invited to submit an application and essay in order to be selected to attend the Institute. Tuition was paid by MUMC and SACS credits were awarded.

One of the teachers who attended the Institute commented, "We both felt we had learned a great deal that could be used in our AP classes this fall. Benita Albert [instructor] was excellent, patient, and personable. The workshop is well worth it; each teacher had a positive experience." The second teacher remarked, "The $300 registration did seem steep. We received great handouts, viewed new books and software, and obtained new updates from the College Board. Terrific!"

## Elementary Workshops

Two MCS teachers were awarded travel expenses to attend a conference on *Mathematics Their Way* in January, 1990, in Saratoga, California. All of the expenses were allocated for a third teacher to attend "Math--A Way of Thinking for Grades 4-6," a one-week workshop held in Nashville, Tennessee, in July 16-20, 1990.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

Four collaborative teachers attended the Teacher Leadership Workshop. EDC sponsored three Memphis teachers, paying for room, board, registration, and transportation. The collaborative paid for the other teacher to attend. The four teachers selected were active in the collaborative and had expressed interest in attending.

The consensus among the MUMC teachers who participated in the workshop was that the seminar was "nice but taxing." They felt that it was designed as a forum at which collaborative teachers were to inform EDC of what equity is all about and how it is addressed in each collaborative city. The teachers felt they learned a great deal during the conference. Unfortunately, they also felt that conditions on their arrival were below standard and that they were the last for whom readjustments were made during the week. They reported that following the first weekend, all of the teachers complained about the rooms and that some improvement resulted.

## National Council of Teachers of Mathematics (NCTM) Regional Meeting

The NCTM Regional Meeting was held in Chattanooga, Tennessee, March 15-17, 1990. Three collaborative teachers who attended had their expenses reimbursed by the collaborative. Roberta Heard, a collaborative teacher and a member of the State Task Force, also attended the conference. As a member of the State Task Force, her expenses were covered. In addition to attending NCTM meetings, the MUMC representatives met with members of the new collaborative in Columbus, Georgia, in an effort to assist them in the development of their collaborative. The Governing Committee had determined that the three teachers who would receive funding had to be active MUMC members, so that they would be able to share successful MUMC projects with the Columbus Collaborative. The Memphis teachers reported being impressed by the teachers from Columbus and by how advanced the Columbus collaborative seemed.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Ten collaborative members, including 7 teachers, the 2 collaborative coordinators and the collaborative on-site observer, attended the 68th Annual Meeting of the NCTM in Salt Lake City, Utah, April 18-21, 1990. The collaborative provided funding of $536 for each of five teachers--three elementary teachers and two secondary teachers. These teachers were selected by an MUMC Governing Board subcommittee composed of business, university, and teacher members. The collaborative also provided funding for the two coordinators; the on-site observer received travel expenses and three nights lodging from the UMC Documentation Project at the University of Wisconsin-Madison. The remaining two collaborative teachers received funding through a grant application prepared by Memphis State University, as a result of their leadership roles in the Transitional Arithmetic Project. In addition to the 10 collaborative-supported attendees, 8 other Memphis teachers, including some MUMC members, attended with Title II funds.

The theme of the conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened for the purpose of seeking new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

All of the teachers seemed pleased to have had the opportunity to attend the conference and felt that they left with a number of excellent ideas. One teacher remarked, "The Wednesday evening reception provided a wonderful opportunity to meet and share ideas with UMC members from other cities." Another teacher said, "I feel very honored to have been chosen to attend the NCTM meeting. Talking with 'math people' from other places was a great educational experience. Ideas were exchanged and comparisons were made. Every session offered at least one good suggestion. I reported only on the ones that impressed me the most. Hearing Lola May the umpteenth time was just as electrifying as the first time." A third teacher commented, "Thank you for sending me to my first NCTM meeting. I learned so much and I interacted with so many teachers from so many different states. Thank you again for sending me to NCTM's meeting. I have been motivated to work harder with my students and to become a leader of teachers. I think that all of

UMC's sessions were very good. I invited two friends to our sessions and they were impressed and would like to start a UMC group in their school districts. . . ."

## Summer Internship Program

During the summer of 1987, MUMC successfully initiated a summer internship program to provide teachers an opportunity to work in a business environment that uses mathematics. Four teachers participated in the program in 1987, and three teachers had internships in the summer of 1988. The program was expanded to offer five internships during the summer of 1989. One intern was placed at Memphis Light, Gas and Water, one at Baptist Memorial Hospital, and one at the University of Tennessee Medical Center in Memphis. Two interns were placed at St. Jude Hospital. A listing of available internships was mailed to all collaborative members. Applications were sent to the collaborative office and then were forwarded to the interested businesses. All participants interviewed expressed great enthusiasm about their internship experience. They learned that working in business was very different from teaching. The businesses treated them as professionals--not the way they felt teachers are normally treated. The interns saw mathematics being applied and planned to include this realistic picture in their teaching.

## Collaborative Newsletter

In the fall of 1987, the collaborative published the first issue of its newsletter. *The MUMC Bulletin*, which continues to be published semiannually, was distributed in 1989-90 to approximately 350 elementary and secondary teachers, as well as to representatives of the business and university communities who serve on the Governing Committee. The newsletter is an important vehicle for distributing information to collaborative teachers regarding collaborative events, conferences, activities, issues in mathematics, and teaching suggestions. In 1989-90, Rita Ross and Virgie Cox, two members of the Operating Committee, edited the newsletter, formerly edited by the associate coordinator.

## E. Observations

### Project Management

The modified structure for governing the collaborative through a 25-member Governing Committee and with the support of an eight-member Operating Committee has worked well for making program decisions and for planning activities. The full time associate coordinator and the part-time coordinator have been able to oversee the operations of the collaborative, with the result that a very aggressive collaborative program was mounted for the 1989-90 school year. Linda Sklar, the director of the Division of Ford Foundation Projects and Optional Schools for the Memphis City Schools, has served as an ally in providing advice to the coordinators and a link to the school district's administration. Herman Ewing, the collaborative director, continues to raise critical issues of equity and improvement in the collaborative's service to underachieving students.

The timely payment of bills and the control of funds were a source of tension during the school year between the Memphis Urban League and the Governing Committee. For the coordinators and others on the Governing Committee, the financial arrangements have proved frustrating and debilitating. In the view of the collaborative director, the main problem is not simply financial but one of administration and communication. The root of the problem goes deeper than the release of funds and appears to reflect fundamental differences in perspective about what the collaborative should be. Such differences, which are not unique to Memphis, have been raised in other collaboratives. The Board of the host agency, as well as the collaborative director, has held that the ultimate goal of the collaborative is to improve the achievement of underachieving students. The Governing Committee and collaborative coordinators focus more on providing professional experiences for teachers that indirectly have an impact on students. In the case of Memphis, the collaborative director has been able to draw attention to questions of student outcomes by managing the funds and requiring that all expenditures receive approval of the Memphis Urban League Board.

One view of why there still is not total agreement among those parties with a vested interest in the collaborative is that the people who are to work together collaboratively have not sat down with each other to talk about the collaborative's role and function.

People have been able to come to an agreement on plans and activities, but have not agreed on their common beliefs about teaching, students, and the collaborative. The collaborative director views the collaborative as a social institution rather than as an association of professionals. A social institution, such as a church, is an organization comprised of people who share a common belief. An association of professionals is comprised of those who work in common areas. The collaborative director views members of the collaborative as sharing their work but not necessarily their beliefs about mathematics or the achievement of students. When teachers are asked about the benefits they have gained from the collaborative, the most common response is to name the resources that the collaborative has provided through workshops, conferences, internships, and discussion of common problems. For these teachers, the focus of the collaborative appears to be on professional activities rather than on providing a forum at which people can wrestle with their beliefs and develop a consensus regarding what is important.

Some people recognize that for the collaborative to be hosted by the Memphis Urban League has provided a dimension not possible if and when Memphis State University becomes the host. This is because the MUL has a political agenda committed to bettering the achievement of underrepresented students. The issue is not that teachers would disagree that student achievement is important, but that the issue of equity had not been prominent in discussions and activities until this school year, when the focus of the EDC Outreach proposal, submitted by MUMC, was to obtain money to hold a conference on equity in 1990-91. As a result of being involved in writing this proposal and being associated with business people, some of whom have been contacted through the Urban League, a middle school teacher views the collaborative as a vehicle for equity. This teacher reflected, "I look at [the collaborative] . . . as an avenue of actually keeping on top of a minority work force that is going to keep us abreast of [the field of mathematics] and keep us pushing and trying to bring those minorities up to par and being able to deal with the work force."

The Operating Committee is unique to Memphis. The idea of having a group of teachers working on collaborative tasks on a weekly basis is very appealing. Work is done that would normally have to be done by volunteers. Committee members have time to prepare proposals and plan activities. This structure requires that the coordinator be more a supervisor of people than an office manager or functionary. State Career Ladder money is used to pay for the teachers' time so that the work is subsidized through a contribution from a supporting agency.

However, there are some potential problems with this model--using Career Ladder teachers to serve in this capacity--that may contradict the effort to increase teacher professionalism. A proportion of the work is clerical in nature, such as doing a mailing. There is the question of how such work contributes to the professional development of the teachers. Clearly there has been a benefit in that a core of teachers now understand better what it takes to operate a collaborative. Writing a proposal seems to be professionally stimulating, but stuffing envelopes does not require a teaching background. The Career Ladder guidelines require that teachers complete and submit an hourly time sheet every two weeks--a requirement some view as less than professional. Career Ladder II and III teachers have a special status, which may give the average teacher the impression that the collaborative is being operated by a special group of teachers--a possibility that may discourage some teachers from participating. Although the Operating Committee has greatly facilitated the amount of work that has been achieved through the collaborative office, there are questions about the working concept of the Committee and whether its existence is furthering the overall goal of structuring a professional environment or whether it is more directed towards routine work that any clerical could do. Having members of the Operating Committee serve in the collaborative's office has increased their knowledge of what it takes to operate a collaborative and to develop leadership skills. The Operating Committee then provides a cadre of teachers who contribute leadership to the collaborative. It also provides support via the activities conducted during the year. A balance needs to be reached so that these teachers can increase their professional experience as they learn about and perform the normal operations of the collaborative.

As is the case with other collaboratives, the Memphis Urban Mathematics Collaborative has been struggling to establish itself financially. This has become a greater problem now that the final Ford Foundation grant has been issued. The Memphis City Schools district supports the collaborative by providing extra release days for collaborative teachers and Career Ladder credit for service on the Operating Committee. A committee has been established by the Governing Committee to help solicit funds. One hope is that the grant-writing training that teachers have received through the collaborative will begin to pay off. Teachers have attended workshops on grant writing and have applied these skills in applying for and receiving small grants from groups such as the Rotary Club.

Now more of the teachers are being encouraged to write proposals for large amounts of funding from sources outside of Memphis. The teachers who worked on the proposal submitted to EDC for an Outreach grant serve as an example of the application of proposal-writing skills. A third source from which the collaborative is seeking funding via the business contacts the collaborative has made. The chair of the Governing Committee noted that the business people on the committee have offered useful input on fund raising.

It is estimated that a cadre of about 85 teachers are very active in the collaborative, with another 100 teachers somewhat active. In 1989-90, over 400 attendees participated in over 20 collaborative activities, nearly 300 different teachers. In the first year of the collaborative, some teachers had the impression that the collaborative was primarily for those who taught the higher level mathematics courses. Efforts to expand collaborative programs to offer activities for all grade levels, such as the Swap Shops, have helped to broaden the image of the collaborative as attending to the full range of mathematics courses in the curriculum. One teacher described the existing nucleus of collaborative teachers as those "who want their students to have the very best and know that their students will get the very best if they have better opportunities." This teacher noted the range of those who form this group, ". . . there are some in that nucleus in every level of mathematics . . . elementary level, junior high level, Algebra I, geometry, Algebra II, and the upper level mathematics."

The collaborative has made an effort to provide opportunities for participation and has strived to involve all middle and secondary mathematics teachers, as well as certain elementary teachers, in its activities. If there is a problem in participation, it seems to be due in part to individual teachers who are not willing to get involved, as opposed to lacking the opportunity to become involved. One high school mathematics teacher who was asked if she was aware of barriers to the development of the collaborative responded, "I don't see any obstacles. . . .If [other teachers] run into obstacles, it is because they make them." One teacher on the Governing Committee reported that in order to increase the opportunities for participation, procedures had to be developed that would apply to teachers from a number of schools rather than to only a few. In response to an announcement of one workshop, the plan was to accept the first 30 teachers who submitted an application. However, 10 to 12 teachers from each of three schools mailed their applications promptly while two or three applications trickled in from other schools. The procedure had to be changed to accept the applicants from eligible schools and to make space for those from other schools in the district. This is an example of the type of strategic planning needed to make collaborative resources available to a more diverse population.

At this stage in its development, the collaborative has been able to devise a working administrative structure. Not all of the administrative issues have been resolved, but there is a structure in place that can respond to the issues that exist and that will develop in the future. Financial concerns will continually have to be addressed. At some point the collaborative will probably be forced to set priorities regarding the types of programs it will offer. At present, the MUMC has not reached this point. The issue of equity has been touched on at least to a degree, but not to the extent hoped for. As Memphis State University assumes the role of host agency to the collaborative, new constraints regarding the administration of the collaborative will arise. In a way, this extends the experiment: it will be possible to determine whether the growth that has been achieved in working with the Memphis Urban League will ease the process of understanding that is needed in building a workable structure for the collaborative within the university system.

## Collaboration

The Memphis Urban Mathematics Collaborative has sponsored a wide assortment of activities that have brought teachers together with each other and with people from business and industry, higher education, and the Memphis City Schools. The outcomes from this wide-spectrum approach have resulted in generating a support community for mathematics education in Memphis. This community includes people from all sectors who are enthusiastic about what the collaborative has been able to accomplish. During the four years of its existence, the collaborative has made nearly all of the mathematics teachers in the middle and secondary schools aware of its activities. Through workshops, swap shops, institutes, travel grants, internships, working committees, meetings, and dinner meetings people have become better acquainted and have valued their interaction with those from the other sectors.

The perception of some is that the real gain has been realized by teachers who were already considered to be good. These are teachers who care about their students, who are constantly seeking ways to improve their teaching, and who want their students to have as many opportunities as possible. One secondary mathematics teacher, active in the collaborative from the beginning, reports that she considers her reference group--colleagues she would seek information from and value--as those who are in the collaborative. She explains, "Now it's not because they are in the collaborative. [These are the] teachers who joined the collaborative very early and have stuck with it . . ." This view that the collaborative has benefited teachers who were already good was noted also by a district administrator who commented, "I think the collaborative has benefited a group of good math teachers who possibly would have ventured for help themselves. I think the ones who have benefited were already the outstanding teachers." He goes on to say that this isn't necessarily bad, ". . . in some way these already outstanding teachers have to pull in teachers who really need the kind of help, . . . support, . . . reinforcement, . . . [and] inservice that the good teachers can provide." The large number of teachers who are participating in collaborative activities indicate that the collaborative is reaching a good representation of the mathematics teachers in the Memphis City Schools system.

The Speakers Bureau, internships, and the Governing Committee have benefited teachers as well as individuals in business and industry. Through these interactions, teachers feel they are being understood better by people in business. One teacher on the Governing Committee commented, ". . . the people . . . on our Governing Committee are listening to us more . . . they are really sensitive to our problems now and understand what is really going on." A business representative on the Governing Committee, who sees her role as supporting teachers, has been impressed by the teachers, "I have been very impressed in general with the collaborative partly because it is being directed by teachers. Here is a group of teachers that are actively trying to do something to better their teaching rather than just sitting around and complaining about the condition of education." She goes on to explain her collaborative involvement by making the points that it is important to her professionally to have more students going into mathematics-related fields and important personally because her collaborative commitment is looked on favorably by her department head.

This business person works in the biostatistics department at St. Jude Research Hospital. Prior to becoming associated with the collaborative, the hospital had not had any relationship with public school programs, but had worked with colleges and universities in offering courses. Since participating with the collaborative, a high school mathematics teacher has brought two mathematics classes to visit the hospital and, for two summers, the hospital has given two mathematics teachers internships. She reported that she and others in her department feel that the internships have been worthwhile. The placement of interns has been a learning experience in terms of determining the best approach to take. Some of the internships have involved directed reading while others have included small projects, depending on the computer literacy of the teacher. The hospital views the internships primarily as a service it performs for the community. She explains, ". . . because the teaching role is so different from what we do, we viewed [the internship] mainly as an opportunity for the teachers to come in and see what is happening. . . .By being here six weeks, they get a better flavor of the variety of things we do . . . [and if] they can help out with small projects, that is good. But primarily, it is for their benefit." One of the teachers who was an intern at St. Jude indeed found the experience valuable because it gave him examples of how mathematics was being used in business applications. His experience at St. Jude had given him insights: "We saw some ways that algebra is used in doing statistical analyses. . . .That is an important idea. . . .I use . . . when I talk about certain topics in algebra." For him it was important to encounter new applications of algebra wherever he could.

The collaborative also has brought teachers together with those from higher education to the mutual benefit of both groups. One function that the higher educators have performed is to help teachers develop proposal-writing skills. Because of this, an increased number of mathematics teachers have sought small grants from community organizations. Their success in these experiences has resulted in some teachers venturing further and writing proposals for more money and more detailed projects. In September, 1990, members of the collaborative joined with people from Memphis State University to write a proposal that was submitted to the Tennessee Higher Education Commission. In October, a mathematics professor was awarded NSF funding for PROJECT MERGE+, which will involve the collaborative in offering a probability and statistics workshop for a week during the summer of 1990. This professor values the networking between those in higher education and the school district administration that has been possible through the collaborative. He credits the collaborative with giving him the impetus to submit two proposals to NSF. His success has proved a mixed blessing, however: In addition to his PROJECT MERGE+ program, he has a project working with 50 grade 5-8 teachers to increase their knowledge of mathematics. Because he became so busy during the 1989-90 school year, he has been less active in the collaborative.

Another important byproduct of the Memphis Urban Mathematics Collaborative has been the cooperation achieved among the district administration, teachers, and others in the Memphis City Schools. The deputy superintendent of schools views such collaboration as the way to go. He clarified his position, "We have seen in education that we can no longer function in isolation from the larger community. We have to be actively involved in the business community, the social community, the civic community, and the religious community. . . .We can't go it ourselves." He feels that the collaborative has given him the experience needed to establish from the beginning that the district has truly embarked on a collaborative effort. "When I think of collaboration, I think we are equal partners. I think of mutual exchanges. I do not think of any one institution emerging as 'the leader'." The deputy superintendent also has valued the relationships he has established through MUMC with those in business and higher education and the opportunity to share common concerns.

Teachers are pleased about being supported by the school administration. This is something that they did not experience prior to the organization of the collaborative. One mathematics teacher felt that the district administration has been much more receptive to mathematics teachers than it has to teachers from other content areas because of the collaborative, in part because the collaborative provides the teachers a voice. "It is a group of teachers all saying this is what we need rather than just one teacher complaining." The teachers regard the fact that the administrators and the district curriculum supervisor are working for them as a very positive sign. They also have received favorable responses to their requests from the administration, such as providing collaborative teachers with two additional release days, obtaining computers for some teachers, and having grade 8 algebra recorded on students' high school transcripts.

Diverse forms of collaboration have resulted from the evolution of the Memphis Urban Mathematics Collaborative. The examples noted above indicate that people from all sectors have not only found that they have been able to contribute to the collaborative, but have also felt that they have benefited from being equal partners in the collaborative. Teachers value this. But above all, the form of collaboration that the teachers have valued the most has been the increased interaction with other teachers. One teacher reported, ". . . the collaborative provided another opportunity for me to get to know more teachers in the Memphis area and . . . just to sit down, talk, and discuss problems everybody was having." Another teacher valued the swap shops because "we talked about things that we were doing in our class. . . ."

The teacher interaction within the collaborative has expanded to include elementary teachers. Activities have been offered to help increase the understanding of the teachers across the grade levels. The enthusiasm with which the elementary teachers have become engaged in activities has caused some of the teachers in the higher grades to take notice. One middle school mathematics teacher saw this as a positive sign because it meant that the elementary teachers were willing to learn. Another middle school teacher saw it as an opportunity to address issues related to the achievement level of students entering the middle grades. The extension of collaborative activities across the full range of grades is still in transition, but a start has been made.

What is most striking about collaboration in Memphis is the mutual benefit that has been realized within all sectors participating. A lingering question remains, however, as to whether the collaborative has reached the teachers who may need it the most, the silent teachers who are less sure of themselves and less likely to become involved.

## Professionalism

Professionalism has assumed a new meaning for the Memphis mathematics teachers who have been active in the Memphis Urban Mathematics Collaborative. Prior to the existence of the collaborative, mathematics teachers report feeling isolated, burned out, and confined by existing notions of mathematics and the state-mandated curriculum. Now mathematics teachers talk about sharing ideas, having a support group, piloting curriculum materials, seeking new ways of teaching, implementing new trends in mathematics, and experiencing increased self-esteem. There is no question that the collaborative has stimulated at least some of the mathematics teachers in Memphis toward the achievement of new heights in the teaching of mathematics. This new spirit has been generated by the effectiveness of the collaborative in offering a wide variety of activities for mathematics teachers, providing them opportunities to attend professional meetings and conferences, and encouraging teacher interaction with other teachers, as well as with representatives from business and higher education.

A high school mathematics teacher of over 15 years, who had wanted to be a mathematics teachers since his high school days, reported feeling alone and discouraged prior to the existence of the collaborative. ". . . I felt isolated . . . I felt closed in and not able to communicate with too many folks about what I was doing. I felt a lot of frustration." He became active in the collaborative when he saw the coordinator at an inservice and signed his name on the roster. He was considering leaving teaching for a more lucrative field working with computers. "Not that the collaborative is the only reason I stayed, but it was certainly part of the reason I haven't left." Through the collaborative, he has attended professional conferences outside of Memphis, he has been an intern, and he has participated in other collaborative activities. Now he has a sense that others care about what he is doing, he has developed a support system. ". . . the most important [impact of the collaborative] is . . . that I have been able to meet . . . talk . . . and discuss things with other math teachers." Along with this support he has gained an "expanded view of mathematics and the teaching of mathematics at the secondary level." Because he is learning more, his teaching has changed.

Not only has the collaborative brought Memphis mathematics teachers together, it has also expanded their relationships to teachers in other collaboratives from around the nation. As with the case of the teacher above, interaction with colleagues has resulted in Memphis teachers viewing their classroom teaching differently. One teacher talked about the impact of the collaborative, "MUMC has provided me with an opportunity to share experiences, ideas, and frustrations with my colleagues from all over the country. And in doing so, I now perceive my role as [that of] a facilitator in the classroom. I now feel that it is my duty to seek out new and exciting ways to teach old and new ideas and topics."

Mathematics teachers have taken on more responsibilities for their own profession. The collaborative has given teachers the opportunity to attend the annual NCTM conference, statistical institutes, Woodrow Wilson one-week summer institutes, and leadership conferences. Teachers who have participated in these have returned to Memphis invigorated. Many of these teachers have led workshops for other Memphis teachers. The curriculum review process also has become more open to teachers. Prior to the establishment of the collaborative, teachers felt constrained by the state-mandated curriculum. Now mathematics teachers are engaged in piloting new curriculum materials. Teachers on the Operating Committee are engaged in grant writing. All of these activities indicate that Memphis teachers have become more responsible for their own professional lives and are enjoying what they are doing to a greater extent.

The collaborative has helped strengthen the self-image of teachers and has supported the valuable role they have in society. Teachers felt that their professionalism was compromised by the control imposed on them by the district and by the fact that the students they are teaching seem harder to reach. One teacher noted, "[Students'] attitudes have changed. The interest in mathematics doesn't seem to be there like it was . . . their willingness to put the effort into studying mathematics doesn't seem to be there with as many students as it used to be." A second teacher offered a similar comment, "We are dealing with a whole different age now. They are not like when I first started teaching. I need to upgrade my skills and knowledge and know how to deal with these children . . . ." This same view has been expressed by a number of teachers. What the collaborative has done is give teachers greater access to those in administration. It has enhanced the sense on the part of teachers that they have a say in curriculum and in other decisions. Collaborative activities have given teachers new ideas and support. This has helped excite them--make teaching more fun--and it has motivated them to be more responsive to the needs of today's students. One motivation teachers have for teaching is their conviction that they are contributing to society by helping the children. One teacher put it this way, "Children who we are teaching now are our future and. . . .There is so much that is missing."

It was noted earlier that the collaborative is benefiting those who are already highly motivated. The responses by some of the active collaborative teachers indicate that they also need to be encouraged. An exciting working environment is important if they are to remain in teaching.

Another aspect of professionalism is self-regulation of the profession. The mathematics teachers did not mention this specifically as being a by-product of their collaborative activity. Whereas the collaborative has given teachers encouragement, awareness, knowledge, and support, the teachers do not feel that they have responsibility for reflecting on the teaching of others and providing constructive criticism. Classroom doors are being opened to other teachers--an example is the kindergarten teacher who invited others to visit her classroom. This is a beginning step. However, it is yet to be seen whether teachers will take the initiative in addressing the quality of mathematics instruction across the system and become engaged in a process of assuring that all mathematics teachers reach their teaching potential.

## Mathematics Focus

The MUMC continued to provide a variety of experiences over a range of content and grade levels. Activities addressing a wide spectrum of mathematical topics were offered during the year. Topics included geometry, graphing calculators, probability and statistics, arithmetic patterns, functions, critical thinking skills, linear equations, communication for minority students, technology, mental mathematics, mathematics modeling, transitional arithmetic, discrete mathematics, *Mathematics Their Way*, and advanced placement calculus. Activities were planned for elementary, middle, and secondary grade levels. The range of activities indicate that no particular mathematics focus has been defined; rather activities are decided on according to the interests of teachers, or because some teachers have had experiences they would like to share with other teachers.

The experiences that teachers are having as a result of collaborative programming is changing their conception of mathematics for the school curriculum and encouraging them to make changes in their classrooms. One teacher who had attended a statistics institute in Illinois had never gotten to the statistics in the textbook during the school year partially out of fear that it was too difficult for her students. The institute provided her with new terminology and new approaches through the use of manipulatives such as dice. She tried the material with her students and reported, ". . . my children really did learn . . . ."

The collaborative has expanded to include teachers from some elementary schools. The inclusion of elementary teachers is an example of the effort the teachers have made to address all levels of mathematics education in the district. A middle school teacher active in the governance of the collaborative felt that involving elementary teachers in the collaborative created an important impact on mathematics education in the area. It was her view that the goals of the collaborative are that teachers improve their skills and make mathematics vital for the students by showing them how mathematics is used in all aspects of life. "It starts in elementary school," she explains, ". . . the impression that [elementary teachers give] children at that early age will determine what they will do with mathematics as adults."

Teachers who have been active in the collaborative feel they are keeping current on the latest trends in mathematics education and that they have ideas that they can use in their teaching. For one teacher, the availability of optional approaches is important in keeping students motivated. This teacher explains, ". . . one of the primary problems in teaching mathematics is getting students motivated to learn mathematics. The more ideas you have and the more ways you have to discuss something, . . . the better able you are to meet those challenges from the students." Some of the new information that teachers are gaining through the collaborative has to do with the use of technology in the classroom and the availability of software. One department chair no longer feels stagnant. "I use calculators and computers much more frequently [because of the collaborative]." Another teacher is able to direct her students to work many examples of Cramer's rule with matrices through the use of computers and software she had learned about in collaborative workshops or conferences.

Many of the teachers who have been able to take advantage of the collaborative have done so because their view of good teaching requires that they be open to new possibilities. One high school mathematics teacher who has taught for over 20 years explained that if her students cannot comprehend the material as presented in the textbook, she will look for other sources or other ways of presenting the material to the students until they are able to comprehend. One reason she does this is because she has had teachers and supervisors who encouraged her to do so. But each year she rethinks what she did the year before and analyzes what worked and what did not in order to determine whether there is anything she can do differently to better help her students. She knows she is doing a good job in class when the students are involved and asking questions. She uses daily participation more than anything else to determine grades. But she has found that even when everything seems to be going well, someone brings you down to reality. After feeling that a lesson had gone exceptionally well, hands flying and everybody happily participating, she was approached by one of her lower-achieving students, who said, ". . . you did some teaching today . . . shoot, if I had been paying attention I sure would have learned a lot." "That shot me straight down," she sighed. "He has given me a compliment and destroyed it all at the same time." What makes teaching mathematics so exciting also makes it difficult, working with all of the students. What the collaborative has succeeded in doing is to give this teacher and others support and new ideas that enable them to deal with their frustrations as well as successes.

## F. Next Steps

The collaborative will be sponsoring several workshops and seminars during the summer of 1990. MUMC will sponsor a 3-day intensive seminar on the use of graphic calculators. The seminar, to be held in August, will be conducted by Sandra Halfacre, an MUMC teacher from Overton High School. The teachers who participate in the seminar will be part of a special pilot project during the 1990-91 school year to incorporate the use of graphics calculators into the Algebra II, Pre-calculus, and Advanced Algebra curriculum.

The collaborative will also be conducting a one-week workshop on probability and statistics and a two-day curriculum forum for teachers of grades 5-8 during summer 1990. These two programs are being offered as part of a subcontract that the collaborative received from LeMoyne-Owen for PROJECT MERGE+, which is funded through a grant from the National Science Foundation. The collaborative will be conducting a Pre-Algebra Workshop for 25 MUMC teachers of grades 7-9 August 6-10. The workshop is being cosponsored with Memphis State University (MSU) as part of the Transitional Arithmetic Project to help junior high school arithmetic teachers incorporate algebra concepts into their curriculum. During the workshop, teachers will develop strategies and create materials for the 1990-91 school year. This project is being funded through a $30,000 grant which the MUMC and MSU received from the Tennessee Higher Education Commission.

On July 30 and 31, 1990, the Algebra Real World Applications and Technology Workshop will be held at White Station High School and led by Rita Ross, Nancy Gates, and Portia Cutter. Participants will receive a $60/day stipend.

In addition, MUMC will sponsor teachers' attendance at several enrichment programs during the summer. The collaborative will provide funding for 20 MUMC teachers to attend each of two workshops for secondary mathematics teachers being sponsored by the

North Carolina School of Science and Mathematics, the National Science Foundation, and the Xerox Corporation. One of the two workshops, which are being held July 2 and July 13, will address statistics and the other will address curriculum. MUMC travel grants were made available to MUMC teachers to attend the summer institutes for mathematics teachers, which are being held July 9-20 at the University of Northern Iowa-Cedar Falls and at Northern Arizona University-Flagstaff.

MUMC will pay tuition and housing costs for one secondary mathematics teacher to participate in the Woodrow Wilson Institute on Data Exploration that is being hosted by Middle Tennessee State University. The Institute, which is designed to help teachers of grades 7-12 implement the statistics and probability strands of the NCTM *Standards*, is being held July 16-20. Participants in the Institute may obtain up to two hours of graduate or undergraduate credit in mathematics.

MUMC received a $5,000 grant from the Education Development Center to develop strategies for dealing with equity in mathematics education. Beginning in the fall of 1990, 20 teachers will be targeted to work on the development and application of techniques to help disadvantaged mathematics students. Plans include a one-and-a-half day workshop session, with two follow-up sessions scheduled during the remainder of the 1990-91 school year.

The Fall Regional Meeting of NCTM will be held in Memphis, November 8-10. The collaborative is planning to host a dinner for the Operating Committee, UMC teachers visiting from the St. Louis Urban Mathematics Collaborative, and Grace Kelemanik from EDC.

# SUMMARY REPORT:
# NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the New Orleans Mathematics Collaborative (NOMC) during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the New Orleans Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

## New Orleans Mathematics Collaborative (NOMC)

### A. Purpose

As stated in the proposal submitted to the Ford Foundation, and subsequently modified to include junior high mathematics teachers, the goal of the New Orleans Mathematics Collaborative (NOMC) is to enhance the professional development of mathematics teachers in the New Orleans Public School (NOPS) district and to enrich the teaching of mathematics by providing opportunities for teachers:

1. To work in collaboration with mathematics teachers and other mathematicians in addressing both teacher and students needs;
2. To keep abreast of developments in the fields of mathematics and teaching;
3. To become part of a network of mathematicians; and
4. To experience firsthand the ways in which mathematics is used outside the academic setting.

In support of these goals, the NOMC identified four objectives:

1. To develop site visits and internships for mathematics teachers;
2. To provide workshops for the purpose of enhancing information exchange and materials development;
3. To provide minigrants for teachers to translate out-of-class experience to in-school activities; and
4. To develop mechanisms for networking between classroom teachers and other professionals involved in the teaching, research, and/or application of materials.

### B. Context

The New Orleans Public School (NOPS) system is located in a metropolitan area with a population of 1,256,200; approximately 557,900 people live within the Orleans parish. Louisiana, long partially dependent upon oil for its economic stability, experienced a lessening demand for oil and a severe drop in barrel prices for sweet crude oil during the late seventies. The decline in demand sent the state and local economy into a severely depressed economic spiral, making a long-term impact on state residents in the eighties. Many residents moved from the city and state to seek jobs elsewhere. During the past decade, with assistance from the public and private sectors, attempts have been made to diversify the business/financial base in New Orleans and vicinity in an effort to turn the state economy around and to provide employment for its residents. Although some oil companies moved their bases of operation out of New Orleans, others remained and continued drilling exploration in the Gulf of Mexico for both oil and natural gas. An increasing national demand for natural gas has proved to be lucrative for oil companies that diversified their operations and production methods. According to state Budget Officer Steve Winham, for every $1 cost increase in a barrel of crude oil, $35 million is produced in additional state revenues from severance taxes and other taxes in related economic activity. During December, 1989, plunging temperatures across the northern portion of the nation created a demand for fuel oil that pushed oil prices to $22.98 a barrel.

In December, 1989, subfreezing temperatures in New Orleans caused citrus crop losses in the parish's $1,400,000 citrus industry. The freeze, which killed fish stocks, also caused destruction of a large portion of the area's $54,000,000 fishing industry. During the school holiday break, subfreezing temperatures ruptured waterpipes and ceiling sprinklers in many schools. Water damage estimates for ruined carpeting, ceilings, and flooded libraries reached $500,000 (the balance of the district's annual maintenance budget). Schools were delayed in reopening after the first of the year in order to allow cleanup crews to repair damage. However, in response to the disasters of the winter of 1989 and, in general, to the area's declining economy, New Orleans community leaders have taken a number of steps to revitalize the city and to improve the economy.

After a 15-year effort to open the New Orleans riverfront to tourists and residents, city officials unveiled plans in December, 1989, to spend $268,000,000 in riverfront development in the next decade, mostly in the French Quarter and Central Business District. Among the projects are: a $156,000,000 second expansion of the New Orleans Convention Center; a $40,000,000 natural history museum; a $15,000,000 expansion of the French Quarter riverfront park; a $20,000,000 expansion of the Aquarium of the Americas; a $10,000,000 plant conservatory; a $17,000,000 improvement to the Audubon

Zoo; and a $10,000,000 Species Survival Center for endangered animals. Mayor Sidney Barthelemy termed the development plan, "Riverfront 2000," the largest development project in Louisiana's history. University of New Orleans economist Timothy Ryan said the plan's various projects will create 18,000 to 23,000 jobs, bring 900,000 to 1.4 million new visitors to the city each year, generate $66,000,000 to $84,000,000 a year in state and local taxes, and result in an annual economic impact of $730,000,000 to $950,000,000. All construction projects except the Convention Center expansion will be built by the Audubon Park Commission and managed by the Audubon Institute.

The 700-block of historic Canal Street is a candidate for re-design by 20 architects and landscape architects. A three-day assembly of experts in urban design resulted in a plan to restore Canal Street to its pre-eminence and make it the hub around which the French Quarter and Business District can revitalize. Suggestions included more streetcars on Canal Street, a new hotel in the 100-block of Bourbon Street, many more trees, scores of new residential apartments, and a "people-friendly" atmosphere. Revitalization planning covers the block bounded by Canal, Bourbon, Iberville, and Royal Streets.

As an additional economic stimulus, three Louisiana shipyards were awarded $322,000,000 in Navy and Coast Guard contracts that will provide employment for more than 1,500 people. The contracts include: $128,000,000 to Avondale Industries for one ship; $121,000,000 to Textron Marine Systems to build nine air-cushion amphibious assault craft; and $73,400,000 to Bollinger Shipyards in Lockport to build 12 Coast Guard island-class patrol boats. The Coast Guard patrol boats to be built by Bollinger are often used to police the Louisiana shoreline and to pursue boats smuggling controlled substances and contraband.

A new science center, the Freeport-McMoRan Daily Living Science Center and Planetarium (located in Kenner), opened in November, 1989, and has been visited by many school groups. In April, 1990, its observatory, which includes a 42-seat planetarium, was opened to the public. The telescope is operated by members of the Pontchartrain Astronomy Society.

University of New Orleans economists have produced an optimistic outlook for the New Orleans area economy in 1990. The economists see growing strength during the year in the oil industry, the port, and tourism. A steadily climbing oil/gas rig count and increasing exploration budgets will boost the state's oil industry. Increases in United States exports and the prospect of expanded United States trade with Eastern Europe presents a promising outlook for the Port of New Orleans. In early 1990, New Orleans hosted the Sugar Bowl, Super Bowl, and Mardi Gras, and will end the year with the opening ceremonies of the riverfront Aquarium of the Americas. Additionally, some $500,000,000 will be spent in the area on projects financed by the state Transportation Trust Fund and approved by the voters in October, 1989.

The Orleans Parish School Board has seven members, five of whom are elected by the district and two members are elected at large. The Board president receives $900 a month and each board member receives $800 a month as token salaries. Sworn in on January 9, 1989, for four-year concurrent terms, members of the board were charged by voters with specific responsibility for improving the school system's fiscal image and its low test scores. Dr. Carl Robinson was elected Board president at that meeting. A Chamber of Commerce Business Task Force on Education has suggested that the Board should concentrate on problem solving. In March, 1990, the School Board asked voters to approve a property-tax increase to finance two bond issues. One bond issue was designated for building two New Orleans high schools and the other for creating 300 new classrooms in 22 schools. Both bonds were rejected by the voters in March, 1990. Similar bond issues had been brought before voters in 1988 and were also defeated.

Dr. Everett Williams has served as Superintendent of Schools for the past seven years. His current annual salary is $93,000; his contract expires in August, 1991. In December, 1989, the Anti-Defamation League presented the Torch of Liberty award to Superintendent Williams for his efforts to raise educational standards and to increase community involvement in public education in New Orleans. NOPS had a $274,828,200 budget in 1989-90 and a projected budget of $292,480,700 for the 1991-91 school year. The Orleans Parish School Board may find itself $10,000,000 short when it attempts to balance a general operating budget for the next fiscal year. For fiscal 1992-93, Finance Chief Samuel Scarnato predicts the school system will be nearly $23,000,000 shy of meeting expenses. He blamed reduced state aids, the rising costs of health and medical benefits for school employees, and escalating insurance and utility expenses. For the 1992-93 year, the Board's present $275,000,000 general budget may jump to $319,000,000. Scarnato said the school system will end the present fiscal year in the black because money carried over from the previous year will cover what would have been a $4,000,000 deficit.

Louisiana provides 56 percent of the school budget, followed by local revenues at 40 percent; 2 percent of its funds are from federal sources and 3 percent from other sources.

There are 128 schools in the district; 22 high schools, 12 junior high schools, 13 middle schools, and 81 elementary schools. The collaborative targets teachers from 18 senior high schools and 19 middle and junior high schools. These schools provide the core curriculum and are not specialized, as is the New Orleans Center for Creative Arts (NOCCA). The total school enrollment is over 94,000 and across all grade levels consists of black, 84,748 (89.9%); white, 5,548 (5.8%); Asian, 2,470 (2.6%); Hispanic, 1,473 (1.5%); and American Indian, 16 (.02%). Overcrowding in many public schools has forced classes to meet in hallways, closets, and stairwells. During the 1950s, 371 portable classrooms were erected as temporary solutions to overcrowding and have never been replaced by permanent structures. Many portable classrooms are not handicapped-accessible and lack air conditioning or bathroom facilities. The district needs 500 new classrooms. To alleviate crowding at some schools, additional nearby spaces have been leased in stores and churches. According to NOPS officials, current conditions of overcrowding have been exacerbated by new academic programs, lower pupil-teacher ratios, and the popularity of some elementary school programs. One factor that contributes to overcrowding has been a new state law requiring smaller classes for kindergarten through 3rd-grade to reduce the student/teacher ratio.

Approximately 1,250 students in NOPS in 1989-90 were classified as ESL (English-As-a-Second Language) students. The number of students whose families received AFDC was 30,209. At least 61,600 students participated in the government funded low-cost or free lunch program. Dropout rates for the district were not available. Student to teacher ratios were: high school 26:1; junior high and middle school 26:1; 28:1 in grades 4 to 6; and 25:1 in grades K-3.

Within grades 10 through 12, 12,339 students were enrolled in mathematics courses during 1988-89. Algebra I, II, and Geometry are required mathematics courses for high school graduation. During April, 1990, the CAT test was administered to students in grade 9. Average verbal scores were at the 37th percentile and average quantitative scores were at the 35th percentile. The Louisiana Educational Assessment Program (LEAP) for testing was administered for the first time to 10th- and 11th-graders statewide. In New Orleans, 10th-graders averaged at the 72nd percentile on the verbal portion and at the 64th percentile on the quantitative portion. Students in the 11th-grade were tested in social studies and science; no testing was conducted in grade 12.

The NOPS district employs 5,204 teachers. The ethnic distribution is: black male, 727 (14%); black female, 3,044 (58.5%); white male, 343 (6.6%); white female, 1,026 (19.7%); other males, 17 (.3%); and other females, 47 (.9%). A total of 264 teachers have mathematics as their primary teaching responsibility. At the high school level, there are 178 mathematics teachers; 105 are female and 73 are male. Of that population, 116 (65%) are black; 58 (33%) are white; and 4 (2%) are Asian. At the junior high school level, 35 females and 17 males teach mathematics. Of the 52 teachers, 44 (85%) are black; and 7 (14%) are white; and one teacher is Asian. Within the middle school level, 34 are mathematics teachers: 27 are female and 7 are male. Twenty-six (76%) are black and 8 (24%) are white.

A beginning salary minimum for a teacher with a BA/BS degree is $17,635. The salary minimum for a beginning teacher with a doctorate is $19,324. These salaries will become effective with the new contract date of August, 1990, and will continue through June of 1993. Teachers are represented by the United Teachers of New orleans (UTNO), which also serves as the bargaining agent.

## State Support of Education Initiatives

The Public Affairs Research Council (PAR) produced a report that is a compilation of eight studies dating from October, 1988, in which the private, non-profit research organization took a detailed look at Louisiana's public education system. As indicators of the education crisis facing the state, the Council cited the state's chronically poor showing on high school graduation and dropout rates, student test scores, illiteracy, and other performance measures. The PAR developed a series of suggestions for addressing the problem areas: revamping the state school aid formula; establishing a separate transportation financing formula; allowing more local flexibility in using state money; repealing legal limits on voter-approved property taxes for schools and lowering the homestead exemption; imposing sanctions on local school systems that fail to progress based on indicators of performance being developed; strengthening the state's comprehensive student testing programs; and reducing class size, especially for students at risk. The PAR also noted regarding the $1,400,000,000 minimum foundation program--the vehicle by which state aid is funneled to local school districts--that while in 1947, 56 percent of the money in the formula came from local school boards, by 1967 it had dropped to 14 percent and in the current fiscal year was only 4 percent. The report concluded that improved education was vital to Louisiana's future.

In 1984, the Louisiana State Board of Elementary and Secondary Education mandated that every public high school student needed three mathematics credits to satisfy graduation requirements. The courses included: Algebra I, II, and Geometry. However, 46 percent of all state students who took Algebra I for the first time either failed it or dropped the course. For that reason, in January, 1990, despite objections from the public an integrated algebra and geometry course was added to the Louisiana high school curriculum (to be implemented in the fall of 1990) that could be used in fulfillment of one of three mathematics credits. A main objection to the proposed course was that it gave students an opportunity to avoid higher-level mathematics courses by using the integrated algebra and geometry course to satisfy one of the three mathematics credit requirements.

The state Board of Elementary and Secondary Education added the integrated algebra and geometry course to the curriculum without internal discussion even though some Board members felt that the course compromised the 1984 objective of toughening graduation standards. The new course was "sold" as a way to provide 9th-grade students who possess poor mathematics skills with a stronger foundation before moving on to advanced mathematics. Under the altered curriculum, effective in the fall of 1990, students who score at or below the 40th percentile on the California Achievement Test in the 8th-grade and who have a C average or less in mathematics will be eligible to take integrated algebra and geometry instead of Algebra I in the 9th-grade. Students who score better will take Algebra I in 9th-grade. Pre-algebra will only be offered in 8th-grade and will no longer be a high school course. According to a New Orleans School Board member, there was so much support locally and statewide to offer the course that Board members felt they had to go along with it. The course is backed by state Superintendent of Education Wilmer Cody and the Department of Education.

The 1989-90 school year was the first year that the Louisiana Educational Assessment Program test was administered. The purpose of the examination was to determine whether students were performing at grade level. Beginning in the fall of 1990, schools will receive report cards that consist of an evaluation and progress profile of performance based on several factors. Information to be reported includes student attendance, average ACT scores, and graduation rates. Poor overall school scores may be used as a takeover took by the state when schools are doing poorly. In 1988, Governor Roemer promoted and signed the legislation for the Children First Act, which provided pay raises for teachers--increasing salaries as much as 30 percent over three years--and recertification of teachers every five years based on state performance evaluations and the individual school monitoring program.

The United States Education Department reported in 1987 that Louisiana ranked 49th in high school dropouts with on 60 percent of its 9th-graders graduating four years later, compared with the national rate of 71 percent. In 1989, Louisiana's Department of Education and the state Board of Elementary and Secondary Education embarked on an ambitious effort, coordinated with local school systems, to keep teenagers in school. One goal is to increase the percentage of students who finish a regular high school curriculum to 80 percent by the year 2000. State Superintendent of Education Wilmer Cody, who directed the development of the master plan, said it should not take 10 years. Educators hope that the remaining 20 percent of high school students will graduate from alternative education programs, such as night school programs leading to the GED or vocational schools. More than 30 states are now using Louisiana's method for counting dropouts. The state is formulating a dropout prevention plan that focuses on identifying children at risk of failure as early as infancy. Among those labeled at risk are students from disadvantaged socio-economic backgrounds and those who have failed a grade in school. In addition to state efforts, each school district is developing related programs such as night schools, health clinics, and other social services.

The Louisiana Mathematics Coalition (LaMAC) was given a $10,000 planning grant by the Mathematical Sciences Education Board (MSEB) to develop a statewide program involving mathematics teachers, business, and higher education. The state mathematics supervisor was aware of the New Orleans Mathematics Collaborative and called upon the collaborative administration for advice. Three times during the 1989-90 school year, the collaborative director and coordinator traveled to Baton Rouge to meet with staff of the state Department of Education and others to help plan for LaMAC. Dr. Gordon Saussy, an NOMC Steering Committee member, assisted in writing the proposal. Upon funding, R.

L. Howard, chief executive officer of Shell Offshore, Inc., and then chair of the NOMC, became the chair of the Advisory Board to LaMAC, the Louisiana Mathematics Coalition.

### Professional Development Opportunities for Teachers

Teachers in the New Orleans Public Schools District have several opportunities to pursue advanced degrees at special tuition rates. Loyola University offers local teachers a reduced-tuition fee. It is hoped that this will be an incentive for teachers to enroll in a course after a summer internship at an area business or industry to support the development of classroom curriculum based on their internship experiences. The superintendent of the NOPS has informed district teachers of a special opportunity through Iowa State University that enables mathematics teachers to receive a full scholarship to work on a master's degree. The modest response to the program has been attributed to the high percentage of New Orleans mathematics teachers who already have a master's degree, or are pursuing a master's degree at Loyola University.

## C. Development of the Collaborative

The New Orleans Mathematics Collaborative is one project of the Metropolitan Area Committee (MAC) Education Fund. MAC is a nonprofit, citizen's action organization whose membership includes representatives from business, labor, professional, academic, and religious communities in the greater New Orleans area. In addition to overseeing the collaborative, administrators of the MAC Education Fund supervise the Community Awareness Project, Partnerships in Education, and the Mini-grants for Teachers Program. The annual meeting of MAC was held on March 28, 1990. Kimberley Sawyer, as director of the MAC Education Fund, served as the director of the New Orleans Mathematics Collaborative. Dr. Olympia Boucree was the collaborative's coordinator, a position she has filled since the project's inception. Aldonia Winn-Belton, a mathematics teacher at Clark Senior High School, was the on-site observer.

Two committees are prominent in the governance of the collaborative. The Steering Committee is responsible for making policy decisions for the collaborative and providing general guidance to the administrators. The newly created Teacher Leadership Council

(TLC), formerly called the Teacher Advisory Council, has assumed responsibility for making program decisions. This group of teachers has assumed greater decision-making responsibility by both citing issues it feels the collaborative should be addressing and by doing strategic planning in an effort to resolve these issues. Members of the Teacher Leadership Council serve on the Steering Committee. The potential group of mathematics teachers who are considered collaborative teachers includes approximately 150 secondary mathematics teachers and nearly 100 middle school and junior high school mathematics teachers from the 37 targeted schools.

In September, the president of MAC wrote a letter pledging financial support and program support for the creation of the Louisiana Mathematics Coalition (LaMAC) Foundation. This group submitted a proposal to the Mathematical Sciences Education Board (MSEB) seeking funding to implement the reform principles in *Everybody Counts* and the NCTM *Curriculum and Evaluation Standards*. The governing structure consists of the LaMAC Advisory Board of 40 persons, a Governing Board, a project director, and a codirector.

### Steering Committee

The Steering Committee oversees the operations of the collaborative. The Committee's 24 members include 5 business representatives, 4 representatives from higher education, 5 teachers, 1 representative from the New Orleans Public Schools, 1 representative from the teachers' union, 1 representative from the Louisiana Science Centre, 2 principals, 2 assistant principals, and the collaborative director and coordinator; one position remains vacant. The responsibilities of the Steering Committee include monitoring and evaluating programs and serving as a think tank to solve problems and create new initiatives. R. L. Howard, chief executive officer of Shell Offshore, Inc., served as the chairman of the committee through the April 9, 1990 meeting. He arranged for Richard Pattarozzi, also of Shell Offshore, Inc., to assume the position of chair of the Steering Committee. Mr. Howard had served as chair since the fall of 1987.

The Steering Committee is scheduled to meet quarterly. During 1989-90, the group met three times. The meetings were held in the conference room of One Shell Square.

At its October 30, 1989 meeting, 10 members were present. They heard from one of the company's representatives about the "Say YES to A Youngster's Future" program that is funded in New Orleans by Shell Offshore, Inc. Gordon Saussy, University of New Orleans, reported on the plan for writing a proposal for a state coalition, later called the Louisiana Mathematics Coalition (LaMAC). Ron Masters, Shell Offshore, Inc., gave the intern subcommittee report. He and Dr. Boucree had met with eight of the summer interns and their mentors. All reported profitable experiences. Plans were being made for a social for the interns, mentors, principals, and other representatives from businesses interested in having interns. Two teachers from the Teacher Leadership Council were to become Steering Committee members. Jessie Cooper, a junior high school mathematics teacher, was introduced as the newsletter editor, replacing Ella Butler, a high school mathematics teachers.

At the January, 1990 meeting, the group heard reports from the committees and the coordinator. Then recommendations from the Teacher Leadership Committee were presented to the group. One recommendation was for the district to change its promotion policy regarding mathematics courses in grades 7 and 8. According to policy existing at the time, students were promoted whether or not they passed mathematics. Certain courses tend to be given special status as promotion courses when students are required to receive passing grades in order to be promoted into the next grade. Teachers would like mathematics courses to be considered in promoting students. A second recommendation was for a Carnegie Unit to be given for passing Algebra I in grade 8. If an 8th-grader passed an algebra course taught by a certified mathematics teacher, the student would receive a Carnegie Unit for the course. If the student took the course from an elementary certified teacher, the student would have to pass the course and a comprehensive examination before receiving a credit. Teachers felt this was unfair and that all students should be required to pass the examination before receiving a credit. The third proposal was related to an integrated algebra and geometry course in grade 9 to partially fulfill the state requirement of three years of mathematics (Algebra I, Algebra II, and Geometry). Teachers were divided in their opinion of this proposal. Some felt it would lower the standards. The meeting closed with a report from Superintendent Cody's special committee by Princess Johnson, a mathematics teacher at Beauregard Middle School, who discussed the awarding of Carnegie credits in general.

The April 19, 1990 meeting of the Steering Committee followed the same agenda as the other meetings. Dr. Boucree presented the coordinator's report listing her activities with the subcommittees and the Teacher Leadership Council to the 16 members present. The internship subcommittee reported on the success of the February 6, 1990 reception held for the 1989 interns and their mentors. Dr. Saussy noted that LaMAC had been awarded a $10,000 planning grant from MSEB. The evaluation forms were to be ready in a week for the subcommittees to report the level and degree of individual involvement in the activities held. The Committee agreed to invite four people to join it: Dr. Clifford Weaver, Southern University Education Development; Dr. Jude Soraparu, Education Department, Dillard University; Michael Grumick, Louisiana Power & Light; and an elementary school principal. The meeting concluded with the announcement that Richard Pattarozzi, Shell Offshore, Inc., would become chair of the Steering Committee. Mr. Howard was praised for his leadership and service to the collaborative.

Eighteen members attended the last Steering Committee meeting on June 4. Committee reports were given, including an update on LaMAC, and a request for suggestions on ways to improve site visits, distribution of the June newsletter, and summer activities. Janice Carter reported on the Pupil Program Plan recommending that students who had not mastered the grade-level objectives in mathematics be given some form of enrichment before going on to the next grade. A committee member suggested that the Steering Committee send a letter to the Orleans Parish School Board in support of this plan and that it request a place on the agenda when the Board addresses the issue. The chair of the Teacher Leadership Council, Sadie Hutchinson, reported on plans for the mini-conference that will showcase collaborative teachers and indicated that a nominating committee will identify the names of teachers to be placed on a ballot so that teachers could vote on TLC officers.

The Steering Committee consists of four subcommittees. Each subcommittee has a chair and meets as needed. A major emphasis of Mr. Howard during his tenure was the identification of short- and long-range goals from the five subcommittees of the Steering Committee. During 1989-90, an evaluation report was written on the extent to which the objectives of the collaborative's programs had been met. The evaluation indicated that the mathematics collaborative, during the period 1986-1989, did "satisfactorily pursue its goal and experienced significant achievement of its primary objectives." This conclusion was based on the professional development as well as other experiences of the teachers and their interaction with others from the mathematics-user community. No evidence was available on the impact of these achievements on student performance. The evaluation report serves as a review of the efforts of each of the subcommittees.

**Site Visit/Internship Subcommittee**

The Site Visit/Internship Subcommittee noted that 138 teachers from 27 public junior and senior high schools had participated in site visits. The number of teachers who had taken advantage of these visits resulted in the conclusion that "the objective was achieved with considerable success." Teachers were reported to have valued the site visits and felt they were valuable learning experiences that should be continued and expanded. Thirteen teachers had participated in four-to-six week internships at five participating companies over three years. These teachers were paid by their host companies for their work. At the beginning of the 1989-90 school year, the interns were debriefed at a meeting of the teachers, business representatives, and others from the education community. In their report, teachers indicated that they had gained insight into how mathematics was used in solving real-world problems. However, teachers were unsure how their summer work experiences translated into changes in their classrooms. The conclusion was reached that if it could be determined that the internship experience had a positive influence on classroom practices, then the program should be expanded so that it would reach a larger number of teachers.

The plan for the period 1989-1994 is to increase the number of businesses participating in the site-visit program from six to ten. However, no site visits were held during the 1989-90 school year. Teachers were becoming less willing to leave their classroom to visit a business for a number of reasons. For example, at one school teachers who did not miss any class time had their names put in a lottery to win $100. Because of this lack of interest a moratorium was placed on the site visits to allow time to rethink whether the visits could be made more meaningful to teachers and whether the middle school teachers should be given the opportunity to participate. Some businesses, however, were not sure what mathematical experience they could describe that would be relevant to middle school teachers. The number of internships offered each year is to be increased by 3. During the summer of 1989, 11 internships were provided.

## Workshop Subcommittee

The Workshop Subcommittee reported that 311 teachers had participated in workshops during the period from 1987 to 1989. A variety of topics were presented, including computer literacy, mathematics anxiety, geometry, pre-calculus, writing, problem solving, use of the *Geometric Supposer* software, statistics, and algebra. The subcommittee concluded that the goals of the group were met through the number of teachers who had participated and the variety of topics that were presented. Through these workshops teachers were given opportunities for professional development via small group interchange. Topics for workshops are to be identified by the Teacher Leadership Council in cooperation with the Orleans Parish School Systems' Department of Educational Programming. Funds designated for symposiums will be reallocated to the funding of workshops.

## Symposium Subcommittee

Between 1986 and 1989, five symposiums were held; attendance totaled over 600 people, including teachers and others from the mathematics community. Presenters were from universities, businesses, and the district. The symposiums served both as a social and an educational event. The subcommittee concluded that the symposiums were successful in bringing members of the mathematics community together in an informal setting for communicating with each other. The symposiums also sustained the focus on the teaching of mathematics. Beginning in 1989-90, only one symposium will be held annually. Teachers will assume a more prominent role in the program, which are to be held in facilities provided by the school district.

## Newsletter Subcommittee

Originally, four issues of the newsletter were planned each year; however, this goal was not met. Over the three-year period, 1986-1989, seven newsletters were published, with the help of volunteers. The newsletter provided a means for networking among teachers by keeping them informed of what other teachers were doing, by disseminating information on teaching techniques, and by publicizing other activities in the area related to mathematics education. Because of the difficulty in having volunteers produce the newsletter and due to the lack of resources, the subcommittee felt that the newsletter did not serve as a viable tool for networking. It is expected that the newsletter will become a supplement distributed to participants at the annual symposium, rather than via a quarterly mailing.

## The Teacher Leadership Council

The Teacher Leadership Council, formerly the Teacher Advisory Council, was the core group of the collaborative during the 1989-90 school year. The Council was scheduled to meet at least monthly, but frequently met between its regularly scheduled dates to deal with matters that needed attention. The first meeting of the TLC was on October 12, 1989, from 4 to 6 p.m. Attendance at meetings generally ranged from 15 to 25 teachers, plus the collaborative administrators.

During the second year the Council discussed mathematics education issues in the district and state and formulated positions on these issues. The former Teacher Advisory Council had consisted of one representative from each high school. With the formal inclusion of junior high school teachers in the collaborative, the Teachers' Leadership Council tended to gravitate more to those teachers who wanted to serve on the committee, even though one teacher from each of the 43 targeted high schools, middle schools, and junior high schools was designated as an official member. Sadie Hutchinson, a mathematics teacher at McMain High School, served as the chair of the Council. The name of the Council was changed to incorporate the idea of teacher leadership, following the return of four teachers from the Teacher Leadership Workshop in Newton, Massachusetts, in August, 1989. The change in name reflected the fact that the teachers viewed themselves as responsible for the direction of the collaborative, rather than solely for providing advice on its activities; that is, the group experienced a catharsis and, as a consequence, positioned itself to set the agenda for the collaborative.

The Teacher Leadership Council addressed several issues during the school year. Two of its members drafted the Outreach proposal that was reviewed and approved by the full Council (26 members in attendance) and then sent to EDC. This proposal supported mathematics teachers in lobbying state legislative committees with authority over the state curriculum and other issues related to the teaching of mathematics. The proposal was funded by EDC. Another issue raised by the group was the mathematics graduation requirement. The superintendent supported a reduction in the mathematics requirements. The members of the TLC reached consensus on the point that the lowering of the standards would not serve the interest of their students. A member of the TLC articulated this view at the March 12, 1990 meeting of the Orleans Parish School Board meeting. The collaborative director shared information she had on the LaMAC proposal that had been sent to the Mathematical Sciences Education Board, including a provision that the TLC be better informed of state activities in mathematics education.

Some work of the TLC was done by committees. At its December 7, 1989 meeting, a committee of five teachers was formed to address the implementation of the NCTM *Curriculum and Evaluation Standards*. This group compared the current district curriculum with the recommendations in the *Standards*. A second committee formed at the same meeting focused on pupil progress in the middle grades. Nine teachers were designated to serve on this committee, which was chaired by Princess Johnson, Beauregard Middle School. A nominating committee, chaired by Lillie Albert, Fannie C. Williams Middle School, developed a slate of two for each of three positions--chairperson, vice chairperson and secretary. Toward the end of the school year, a committee chaired by Julie Rai, Fannie C. Williams Middle School, was appointed to oversee the planning of the mini-conference to be held on November 16 and 17, 1990. The TLC primarily nominated teachers among its own membership to attend the NCTM Annual Meeting, the EDC Teacher Leadership Workshop, and the regional NCTM meetings.

The permanence proposal submitted to the Ford Foundation by the NOMC at the end of the 1988-89 school year indicated that a mini-conference would replace the annual symposium. The planning for such a conference was suspended as more pressing policy issues were being addressed. After the NCTM Annual Meeting in Salt lake City in April, 1990, however, planning for the mini-conference was resumed. The mini-conference planning committee decided to draw upon ideas presented by Manuel Fernandez, Wayland Public Schools, Wayland, Massachusetts, who spoke at the UMC meetings coordinated by EDC in Salt Lake. The committee was particularly interested in Mr. Fernandez' comments on parental involvement. Another feature of the mini-conference was to showcase New

Orleans mathematics teachers by having them give presentations. The mini-conference committee met in June and planned to meet at other times during the summer. The conference was set to run from 6 to 9 p.m. on Friday afternoon November 16, and 9 a.m. to 4 p.m. on Saturday, November 17.

## D. Project Activities

During the 1989-90 school year, the New Orleans Mathematics Collaborative sponsored activities that provided opportunities for public junior and senior high school mathematics teachers to: (1) interact with one another, as well as with their colleagues in business, industry and academia; (2) stay abreast of new developments in the fields of mathematics and mathematics education; and (3) gain firsthand experience with the use of mathematics outside of the school setting. The collaborative also encouraged teachers to participate in a Mini-Grant Program sponsored by the Education Fund of the Metropolitan Area Committee.

### Industry Internship Program

The collaborative, in conjunction with Loyola University in New Orleans, initiated the Industry Internship Program during the 1987-88 school year. The program is designed to provide teachers an opportunity to work in a business environment with the anticipation that they will return to the classroom with more creative teaching skills, techniques, and real-world applications. During the summer of 1988, the first year of the program, two senior high school mathematics teachers worked as assistant statistical analysts in the sales and marketing department of the Port of New Orleans. In the summer of 1989, 11 secondary science and mathematics teachers representing 6 high schools participated in the summer internship program sponsored by the U.S. Department of Agriculture's Southern Regional Research Center (SRRC), the First National Bank of Commerce, Freeport McMoRan, and Shell Offshore, Inc. Eight teachers worked at the Southern Regional Research Center, one teacher worked at Shell Offshore, Inc., one teacher worked at Freeport-McMoRan, and one teacher worked at the First National Bank of Commerce. The internship program provided an opportunity for the teachers to put their professional knowledge of mathematics to practical use. The interns at SRRC, for example, worked on projects that included measuring cotton fibers to see how many broke during processing, designing graphs that show how a catfish's diet affects its flavor, measuring chlorophyll fluorescence in stressed and nonstressed cotton plants, altering the fungus that produces deadly aflatoxins in peanuts, and measuring how much formaldehyde is given off when permanent-pressing a cotton garment. The teacher intern at Freeport-McMoRan, Inc., planned the buying and selling of mineral properties.

The teachers who participated in the internship experience were extremely positive about the program. They felt that it provided an opportunity to observe the utilization and application of mathematics to real-world problems. One teacher commented, "It was my first opportunity to utilize what I've been teaching." Another teacher said, "It felt really good to find that I was valuable in some other capacity, that I could do something else." A teacher who had worked at the SRRC explained, "I can relate to my students how important it is to accurately mix a solution. If you're off by a small amount, it can ruin the experiment." Another teacher who had been an intern at SRRC said, "Most students haven't thought about long-term about careers. The more careers you're exposed to, the more you can counsel them." In an article that appeared in the spring issue of the *New Orleans Mathematics Collaborative Newsletter*, a teacher wrote, "This summer I worked at Freeport-McMoRan, Inc., a global resources company, as an assistant in strategic planning. My position entailed much to do with my field. I finally got a chance to see algebraic calculations being used at the business level. This experience will give some substance to my answer when the question arises from students, "What do we need this for?" I recognized the workings of mathematics in the business world, from arithmetic computation to Algebra II. This whole experience was very rewarding and appreciated. It has helped me create a priority list in my classroom with emphasis being placed on the kind of problems, especially word problems, in Algebra I that will prepare students for jobs in businesses like Freeport-McMoRan." From the perspective of the host businesses, the program was also very successful. The director of SRRC remarked, "Everybody knows how statisticians are. All these people [teachers] had strong personal skills. . . .You find out all science is ultimately people."

One of the objectives of the program is for teachers to translate their internship experience to the classroom. The coordinator of the program, Tricia Stulz, acknowledged that the program's effect on teaching is subtle, but several participants have reported that as a result of participating, they give their students less theory and more applied problems of the sort, "You have 21 pieces of fruit and twice as many apples as oranges . . ." The collaborative, in conjunction with Loyola University, is continuing to investigate the development of the academic coursework component of the program, which would focus on developing classroom materials. Participating teacher interns will be eligible for reduced tuition.

On February 6, 1990, the collaborative sponsored a reception to honor the participating teachers, mentors, and businesses in the 1989 Summer Internship Program. The reception, which was held in the Inter-Continental Hotel from 4 to 6 p.m., was hosted by Shell Offshore, Inc. At the reception, the teachers had an opportunity to share their summer experiences. About 25 people attended, including the interns, their mentors, the collaborative administrators, and some members of the Steering Committee. The only collaborative teachers invited were the interns.

The internship program will continue during the summer of 1990. Two area businesses will participate, Shell Offshore, Inc., and the U.S. Department of Agriculture's Southern Regional Research Center. It was expected that all of the organizations that had had interns the previous summer would continue with the program in 1990 along with some new companies, but only two of the organizations decided to continue.

### Mini-Grant Program

The collaborative encouraged teachers to apply for mini-grants offered by the Metropolitan Area Committee (MAC) Education Fund. The MAC Education Fund, a project dedicated to encouraging community understanding of, support for, and commitment to quality public education in New Orleans, initiated its Mini-Grant Program to recognize the initiative and creative potential of individual teachers and to invest in classroom projects that enhanced learning opportunities for students.

Grants of approximately $500 are awarded to teachers on a competitive basis to support the creation and implementation of programs that enhance the lessons of the textbook. All New Orleans Public School teachers and instructional support staff are eligible to apply. Applications are due by July 7 of each year and awards are announced in the fall. Proposals are reviewed by members of the Mini-Grants Subcommittee, which is composed of representatives from the academic, business, civic, labor, religious, and school neighborhood communities, in cooperation with the collaborative staff.

During the past three years, mini-grants totaling $10,500 were awarded to 21 middle, junior, and senior high school mathematics teachers.

The Mini-Grant program enables teachers to implement innovative and creative school projects. One of the projects, for example, that received a mini-grant during the 1988-89 school year was "Real-Life Math and Me," a project designed to provide middle school students in Special Education from Garner Middle School with the opportunity to apply mathematics skills taught in classrooms to real-life experiences, including budgeting and comparative shopping. By the end of the 1989-90 school year, students involved in the project had opened saving accounts at the First National Bank of Commerce, dined at a local restaurant on a limited budget, and shopped at a grocery store using the newspaper to do comparative shopping.

Of the 33 mini-grants awarded int he 1989-90 school year by the Education Fund, four addressed the teaching of mathematics. All four grants were awarded to elementary teachers. One project, entitled "Understanding Mathematics in the Real World," was directed toward the development of a kindergarten and 1st-grade program using hands-on experiences to develop number concepts. Another, entitled "Using Math Games to Improve/Motivate Underachievers," focused on using mathematics games to build children's confidence and desire to learn additional mathematics. A third project, entitled, "Parent and Child--Together in Math," was directed toward parents of at-risk pre-kindergarten children in an effort to involve them in developing and implementing a plan to enhance their child's mathematical abilities. The fourth, entitled "A Multi-Sensory Approach to Learning Mathematics," was designed to teach mathematics to at-risk 2nd-graders using concrete experiences that will help the student link the mental tasks to concrete objects and situations.

## Peer Support Group

The permanence proposal recommended that peer support be established to provide teachers with assistance and services regarding their instructional needs. In addition, the peer groups were to foster teacher leadership, promote collegiality among teachers, and provide technical feedback and positive reinforcement to extend or improve teaching skills. One component of the program focused on bringing together teachers who have specific needs or problems with teachers who have a special competence or interest in those areas. A second would provide stipends to teachers who have exhibited leadership in exchange for working with their peers and conducting workshops. The third component of the program is to provide non-threatening evaluations of teacher classroom behaviors. This is to be accomplished by videotaping interested teachers and having collaborative teachers critique their performance, using in-kind support from the school district's Department of Media and Technology. The collaborative administration began planning with the district administration during 1989-90 to develop peer support groups. These will be implemented in 1990-91 with the help of local universities.

## UMC Outreach Action Grant

A team of eight teachers from the NOMC worked collaboratively to prepare a proposal in response to a request for proposals for UMC Outreach Action grants. The goal of the proposal, "Teachers Trained to Lead" (TTL), is to organize, train, and mobilize mathematics teachers in grades K-12 to discuss educational issues, pursue policy initiatives at the state level, and influence state policy makers. Using the $10,000 in funding awarded through the grant, the teachers will attend legislative sessions and other state education meetings in their efforts to influence decision making.

The team of teachers submitted a draft of the proposal to the Teacher Leadership Council to discuss at the January 24 meeting of the Council. Suggestions from Council members were incorporated into the proposal and the completed proposal was submitted to EDC in early February.

The grant was awarded to NOMC on March 12, 1990. By the end of the school year, two teachers had traveled to Baton Rouge and spent a day attending a meeting of the state legislature's Education Committee. The two teachers learned how legislative decisions were made and what could be done to lobby for their cause. Bill LeMoine, Kennedy High School, and Lorene Dunlap, Livingston Middle School, reported their findings to the TLC upon their return. One of the authors of the proposal requested of EDC that some of the Outreach grant be used to fund teachers to attend the one-week Woodrow Wilson Institute on Algebra to be held in August, 1990. Use of the Outreach grant was approved for addressing policy issues, not for normal professional development experiences, which are funded through regular collaborative funds. In the letter sent by Brian Lord to Jessie Cooper, Phillips Junior High School, concern was raised as to how attending the Algebra Institute related to working with the legislative process. Ms. Cooper responded by letter on June 3 indicating that gaining in knowledge of algebra will assist the Teachers-Trained-to-Lead participants in talking with members of the legislature. Permission to use funds in this way was granted. Work will continue on the TTL project into the next school year with the hope of trying to arrange meetings with key legislators. An effort was made to give the project focus.

### District Title II Workshops

The district mathematics supervisor, Louivinia Wallace, had 17 of the collaborative teachers help in conducting workshops for other district teachers in June, 1990. Title II funds were used for stipends to both the workshop leaders and participants. A total of 12 workshops were given during three time periods--June 14-15, June 18-22, and June 25-29. The workshops, available to all mathematics teachers in the district, were attended by 298 teachers. These workshops provided a forum for collaborative teachers who had attended inservice activities through the collaborative to share what they had learned with other teachers in the district. No comments were available from teachers who participated in these workshops.

### National and Regional Conferences

The collaborative allocated $5,000 to the Teachers' Leadership Council to fund teachers' attendance at national and regional conferences during the 1989-90 school year.

Teachers who had not previously received support from the MAC Education Fund to attend a conference were given priority.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue which is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about mathematics change as only one aspect of the school restructuring reform movement; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

Four secondary and middle school mathematics teachers were selected by the collaborative director and coordinator from among the teachers who were frequent participants in collaborative activities to represent the New Orleans Mathematics Collaborative at the workshop. EDC had agreed to sponsor two teachers from each collaborative, paying for room, board, registration, and transportation; the other two teachers were funded by the collaborative.

In preparation for attending the conference, the four teachers participated in a gathering sponsored by the collaborative in June, 1989, that focused on a discussion of equity. The four representatives summarized the teachers' comments for presentation at the Leadership Workshop.

## Woodrow Wilson One-Week Summer Institute

During the week of August 14, 1989, 20 teachers from the New Orleans Mathematics Collaborative and New Orleans area attended the Woodrow Wilson one-week Summer

Institute on Statistics in Society and other topics. The Institute was presented by four Master Teachers who had received training at Princeton University under the direction of the Woodrow Wilson Fellowship Foundation. The collaborative paid the expenses for the 17 collaborative members who attended. Of the 20 Institute participants, 6 taught students in the middle grades, 2 taught primarily 9th-graders, and 12 taught students in grades 10-12. Fifteen of the participants had 15 or more years of teaching experience. Half of the participants had attended the Woodrow Wilson Institute the previous year.

Six months into the 1989-90 school year teachers reported that the Institute had had an impact on what they teach and on their students. Twelve of the teachers responded to a questionnaire sent to them in March, 1990, by the Woodrow Wilson National Fellowship Foundation. All of these teachers indicated that the overall impact of the Institute on course content and their teaching was either moderate or high. Two-thirds of the responses indicated that the teachers had added new content in a few places in the courses they were teaching. For example, one teacher noted that in the first semester topics in statistics were covered once a week and that students did group projects outside of class. All of the responding teachers reported at least some increase in their knowledge of general content and real-world applications as a result of attending the Institute. This has changed what some teachers do in their classrooms. One teacher reported, "I am able to accurately provide my students with new and efficient ways of using probability and statistics in their lives." All of those responding noted that the Institute experience had increased at least some their interest in curriculum reform; the interest for half of them had increased a great deal. All but one of the teachers noted that when compared to previous years, changes they had made due to the Institute had increased their students' interest in mathematics as well as their involvement in learning mathematics. Three-fourths of the teachers noted at least some increase in students' achievement. One teacher reported on the changes that had been made, "I have designed a unit, using the materials I received and the materials from the institutes. The unit is used in geometry for my 10th-graders. The unit involves collecting data in the school, doing an analysis of the data and presenting it. The students make predictions from their results. I use the materials for the section of [the] advanced mathematics course that presents probability and statistics. . . . My students like to work with the concepts and techniques of the statistics unit. The approach is a welcome change from the usual. They like creating their problems and solving them."

### "Leading Mathematics Into the 21st Century"

The collaborative sponsored the attendance of three elementary school teachers and the district elementary mathematics specialist at a meeting on the NCTM *Standards* that was held in Dallas, Texas, on February 12, 1990. The conference, which was a national awareness endeavor, was sponsored by American State Supervisors of Mathematics (ASSM), Council of Presidential Awardees in Mathematics (CPAM), the Mathematical Sciences Education Board (MSEB), the National Council of Supervisors of Mathematics (NCSM), and the National Council of Teachers of Mathematics (NCTM). The four participants shared what they had learned with the Teacher Leadership Council at its February 22, 1990 meeting. The collaborative sponsored the attendance of the four from NOPS in response to a request from the state mathematics supervisor to have representation from the district on the state team. In the past, rarely had such a request come from the state Department of Education.

### Louisiana Teachers Mathematics Meeting

Julie Rai, F. C. Williams Middle School, had her expenses paid by the collaborative to attend the Louisiana Teachers of Mathematics meeting held in Alexandria, Louisiana, on March 1, 1990. The TLC allocated the funds needed for her to attend.

### GNOTM Mini-Conference

Members of the TLC were encouraged to join NCTM and the Greater New Orleans Teacher of Mathematics (GNOTM) organizations and to participate in their activities. At the GNOTM meeting on March 24, 1990, Dr. Boucree gave a presentation describing the collaborative. The session, which about 15 people attended, provided some publicity for the collaborative. An unknown number of collaborative teachers attended the meeting, but none were given collaborative funds to do so.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Teacher Leadership Council of the New Orleans Mathematics Collaborative awarded grants to nine middle school/junior high/secondary mathematics teachers to attend the NCTM 68th Annual Meeting in Salt Lake City, Utah, April 18-21, 1990. Each participant received $300 to offset the cost of registration fees, travel, and lodging. In addition to these teachers, the collaborative director and coordinator and the on-site observer, Aldonia Winn, who received funding from the UMC Documentation Project, attended the conference.

The theme of the NCTM conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened seeking new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and working sessions with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, whose address was entitled, "Students of Color Through Staff Development." The teachers who attended the conference enthusiastically reported on what they gained from the experience. As a result of hearing Manuel Fernandez, he was invited to be the key-note speaker at the November 1990 mini-conference.

### Collaborative Newsletter

The *New Orleans Mathematics Collaborative Newsletter*, which is distributed to secondary, junior high and middle school mathematics teachers in the New Orleans Public Schools, collaborative board members, MAC Board members, business partners, and school district administration, was first published in 1987-88. The newsletter is designed to keep teachers and the community informed about collaborative developments as well as to provide a forum through which teachers can express their ideas on effective teaching techniques. The newsletter reports on collaborative activities, offers commentary from teachers, provides articles on mathematics topics, and includes a calendar of upcoming events.

During 1989-90, one issue of the newsletter was published. The collaborative encouraged representatives of the business community to use the newsletter as a vehicle for expressing their views on mathematics education and on the collaborative in general. The spring issue of the 1989-90 newsletter, for example, contained an article by an account executive at Dean Witter Reynolds in which she discusses a presentation she made to students at Bell Junior High School. In past years, the newsletter was printed by a commercial printing company. To eliminate the printing cost, this year it was printed by the district. However, it was given low priority and was printed eight to ten weeks after it was submitted--one reason for the single issue during the year. In June, 1990, the newsletter editor was soliciting articles from those on the TLC and Steering Committee for a future issue.

## E. Observations

### Project Management

The project management of the New Orleans Mathematics Collaborative has remained stable since its inception in 1986. NOMC, one of the newer collaboratives, used the experience of the older collaboratives to its advantage in developing an organizational structure that included a director, coordinator, steering committee, and teacher council. The directors have changed, but the coordinator, Dr. Boucree, has been with the project from its beginning. Dr. Boucree has contributed to the success of the NOMC in attracting teachers to the collaborative as a result of her history with the school district and the respect she garners from teachers and district administrators. The current collaborative director, Kimberley Sawyer, has been very active in providing leadership, energy, and vision. Both Dr. Boucree and Ms. Sawyer spend time with teachers and others in planning activities, encouraging involvement, and attending to details to ensure that events go as planned. The MAC office has not only provided a supportive environment for administrating the collaborative but has helped to maintain links to community leaders and resources. These connections make the collaborative part of the community and gain the participation of influential community leaders.

The Steering Committee has worked conscientiously to engage members of the business and higher education communities. Through this Committee and its subcommittees, people have remained active in the collaborative over a number of years. One reason for this has been their meaningful involvement with various components of the collaborative. A professor from the University of New Orleans has guided the Symposium Subcommittee and then become active in doing the state planning for LaMAC. An engineer from Shell Offshore, Inc., has been responsible for overseeing the site visits. The chair of the Steering Committee, the chief executive officer of Shell Offshore, Inc., has contributed by guiding the group to define measurable goals and to use these to determine the collaborative's effectiveness. Because of his participation with NOMC, he also was asked to work with LaMAC. The interest level has been retained so successfully that these leaders and others have actively participated on the Steering Committee for over three years.

The Teacher Advisory Council got off to a slow start, but has now evolved into an important decision-making body for the collaborative. The need for the Council was not envisioned at the beginning. But as the collaborative evolved and the collaborative administration increased its contact with other collaboratives, it soon became apparent that there had to be some means for including input from teachers. Selected teachers served on the Steering Committee, but they really did not represent the targeted group. Initially members on the Teacher Advisory Council were not sure what the group's function was. The teachers, one from each high school, were undecided about what they should do. Few teachers actively participated in the group. The Council was left on its own, without leadership from the coordinator, with the idea that if teachers were to gain in power they needed to take initiative and assume responsibility.

The demeanor of this group changed over the summer of 1989 as a result of two events. The first was the preparation of the permanence proposal, which involved the collaborative in developing a final proposal to the Ford Foundation for $100,000 in funding for the period 1989-1993. Teachers who had been identified as having leadership potential were brought into the planning process in May, 1989, at a symposium where roundtable discussions were held and the teachers listed their concerns. The planning process entered another stage when the teachers met with the director and coordinator to decide how the funds from the permanence grant should be spent. This planning process represented a break in tradition in that the teachers began to realize that they could exert some control over the collaborative's development. At this meeting, all of the planning documents and the budget were shared with the teachers. The meeting was described by the director, "We had about 10 or 15 teachers there who spoke quite frankly about what was going on in the schools in terms of mathematics, in terms of passing kids on who really didn't know what it was about. They expressed their concerns and we said, 'Here, this is the proposal that we submitted for the continuation of funding. Read it. This is everything there is.'" Out of this planning process some innovative ideas for NOMC evolved, including provisions for peer sharing groups and a mini-conference. Further plans were made and teachers were grouped into committees that were to meet over the summer. However, most of these committee meetings did not take place, although some groups did meet in the fall.

Throughout the planning process, teachers still had some difficulty in assuming leadership responsibility. However, a second event occurred that made the summer of 1989 a turning point. Four New Orleans teachers, including a middle school teacher, attended the Teacher Leadership Workshop held in Newton, Massachusetts, under the coordination of EDC. This team returned with new skills, enthusiasm, and the conviction that teachers could make a difference. Part of this was due to the fact that they learned from other teachers what they were doing in their collaboratives. Returning to New Orleans with renewed energy, the four teachers were instrumental in changing the name of their Council to the Teacher Leadership Council. The change in name reflected a change in role, the forging of a new identity, since the teachers now perceived themselves not as advisors, but as decision-makers.

The group began to meet monthly--more frequently when needed--to discuss what the teachers regarded as important issues in mathematics education. The coordinator assumed a more supportive role, reinforcing the work of the chair of the TLC and asking questions in a way to ensure that administrative details were being covered. But the message had become clear that the collaborative belonged to the teachers and that the role of the collaborative's administration was to support the teachers in what they decided to do. The issues they addressed were district and state policies that heretofore were considered out of reach because of the perceived power of the district and state. The work of the Teacher Leadership Council during 1989-90 became the major work of the collaborative.

Thus, it appears that a new structure is in place for operating the collaborative. The status of the groups involved has changed as the collaborative has matured and the Teacher Leadership Council has become a decision-making body for teachers. Given the empowerment of this group, the question arises as to whether it will retain its current focus or venture out to take advantage of the resources that have been developed through the collaborative, such as expanded contact with business and higher education through those who have served on the Steering Committee. This has been achieved to a certain extent by having business people write articles for the newsletter and planning to have business and higher education representatives participate in the mini-conference.

One new possibility for expanding the range of the collaborative would be for the TLC to create its own vision and its own plans to make that vision a reality. Those in business have the experience to help in developing a process to do this. One business associate has noted the need to develop a system for the collaborative that would objectively state goals and then measure the degree to which these goals had been attained. He has observed that this has been difficult for the collaborative to do. One reason is that those from the schools have a tendency to generate qualitative goals that are difficult to measure. To him, this is not due to problems with collaboration as much as to the lack of experience in generating the means for measuring outcomes. He sees this at an area in which business can make a contribution. He is a realist and understands that small steps are needed, ". . . we would be naive to think we're going to turn around mathematics teaching results in any short-term period. The only thing you can hope to do is just bite off a little bit at a time and hopefully make steady progress toward the desired end." Assistance in clearly envisioning long-term goals and creating a plan to realize those goals would be a valuable contribution from the business sector. By the end of 1989-90, this had not happened.

If the collaborative continues to gravitate toward the Teacher Leadership Council as a major component, as was happening in 1989-1990, there is the possibility that the group will turn inward as it develops its strengths rather than broadening its resource base to help in the clarification of ideas and achievement of goals. There also is a tendency to provide Council members with financial support to attend meetings rather than actively pursuing a strategy to broaden the participation in the collaborative by including other teachers. Hopefully, the TLC will have the wisdom to build upon its history in harnessing strong community support of the collaborative and bringing this to bear on the important state and district policies that are being addressed, while seeking strategies to expand the benefits of the collaborative to other teachers.

During 1989-90, the collaborative expanded to include middle grades mathematics teachers, increasing the potential teacher membership to over 200. At the beginning of the school year, an estimated 50 teachers were considered very active participants in the collaborative. Extending membership to include junior high and middle school mathematics teachers has given the collaborative new energy. Many of these teachers have assumed leadership responsibilities on the TLC. Collaborative teachers feel the need for a K-12 membership if the important issues relating to students learning mathematics are to be resolved. After four years, the collaborative has reached a new phase in its development and is in a better position than ever before to effect change. The TLC has become more pro-active. The teachers are talking about districtwide and statewide issues. In this new phase, there may been a need for a new management structure. The challenge for the collaborative lies in its ability to build upon past capacity for actively engaging those from business and higher education as it develops a structure that can support the agenda of the Teacher Leadership Council. The success of this new phase seems to depend on how the resources and expertise available to the collaborative can be concentrated on making significant policy changes that will raise the quality of mathematics education in the New Orleans Public Schools.

## Collaboration

As the organizational structure changed over the 1989-90 school year, certain forms of collaboration were given more emphasis than others. The Steering Committee still provided a link among the representatives of business, higher education, teachers, and the district. Site visits were not held during the year, but during the summer 11 teachers served in area businesses as summer interns, the highest number so far. For these 11 positions, there were about 25 applicants. The interaction between the interns and their mentors continued through the fall, during the evaluation session and social gatherings.

Nearly 30 teachers worked together through the efforts of the Teacher Leadership Council. Two of the TLC teachers were the principal authors of the draft of the Outreach grant proposal. The state mathematics supervisor is more frequently turning to resources from the collaborative to help with state initiatives. What the New Orleans Mathematics Collaborative has been able to accomplish is collaboration that has been interactive and beneficial to each of the different groups that have participated.

The 1989 summer internships were particularly successful in providing valuable experiences to teachers and some support to the participating businesses. An appealing feature of the internships is that they do not require significant collaborative funding. They do require effort on the part of those responsible for locating businesses and matching their needs with a teacher. Through the internships, participants learned how to use the computer, increased their confidence, and gained a new perspective on teaching. Each of the 11 internships required some use of a computer. The internships were not without risks, but the mentors and interns were able to work together to meet the challenges that confronted them. Some of the interns were science teachers. One teacher who worked at the Southern Regional Research Center of the United States Department of Agriculture was very concerned about working in the laboratory because he was afraid of making a mistake. The teacher and mentor were open with each other, the mentor explaining that if the teacher made a mistake then the research work would just have to be repeated. In the fall, the Resource Center was very interested in obtaining additional interns the following summer. The Center valued working with teachers in this way and was a means through which students could be encouraged to work in its laboratories. As explained by the coordinator, "They must get minorities and they must get women [involved] . . . because of the employment needs they will have in the 21st Century." The director commented on the response of another intern to his experiences and how they had changed his view toward his teaching, "He said that he had learned another degree of patience, that he had to be more patient with his students because he was the learner for a few weeks. He saw that he wasn't as patient as he could have been with his students when he was the facilitator and they were the learners."

A third teacher served as an intern for an oil company working on an environmental project. He was impressed with how the different oil companies shared information with each other. "I found out that in the oil industry they share most of the information they have. If it is of help to someone, they share it so they do not waste time trying to develop what has been developed." He contrasted this with teachers, ". . . teachers do not naturally share." He did understand that one of the collaborative's goals was to help teachers learn how to share. The oil company also benefited by having someone who was more understanding of what the company was doing for the environment. The teacher noted his change in views, "I have changed my opinions about them [the oil company] since working there. . . .I was of the opinion big oil companies were just polluters and didn't do anything to try to help the country's environment. . . .It is not true at all. They work to protect the environment." In the winter, an article was published in the newspaper critical of the oil company's environmental work. Knowing that the teacher's opinion on this issue had changed, a representative of the company called the teacher and said that if he was so inclined, it would be appreciated if he would write a letter to the editor giving his view on what the oil company was doing on environmental issues. The teacher did write a letter, but it was not published. This is an example of how the internship program can benefit the company and its image as well as the teacher.

The site visits and symposiums were more important in the earlier stages of the collaborative than they proved to be during 1989-90. As reported in previous annual reports, while teachers appreciated learning more about how mathematics is used in the workplace and what the potential opportunities for their students are, teachers criticized the activity for being too passive. Teachers sought more hands-on activities where they could work with the mathematics or become involved in activities that they could use in their classrooms. In 1988-89, teachers became less interested in going on site visits and in 1989-90 none were scheduled. There was some effort to determine how the experience might be modified to make it more valuable to teachers. Also, the middle school teachers who had recently joined the collaborative did not participate in site visits. There was some question as to whether something should be done for these teachers. The director and the chair of the Site Visit/Internship Subcommittee made an effort to determine how the site visits could be a more significant hands-on experience for the teachers. The site visits, like the internships, are relatively low-cost activities, but require a certain amount of time to arrange.

The symposiums served both as social functions and as forums for reaching a large number of people. These were higher-cost events. As the collaborative's resources declined, the decision was made to have one symposium each year. The symposiums provided an occasion for all collaborative members to come together as a large group. The manner in which the events have been planned and carried out has communicated to teachers that they are appreciated and are part of a supportive group of colleagues. The symposiums were particularly important in the beginning because they attracted teachers to the collaborative. Teachers have indicated that they first got involved in the collaborative as a result of attending a symposium. For example, one teacher commented, "Year before last I went to a [dinner symposium]. . . .There were some speakers . . . from one of the major industries and they were talking about math applications in industry . . . .So the next time I heard of a meeting, I went." The social and informal aspects of collaboration seem to be important. The symposiums provided this type of experience, as much for teachers from within the same schools as for teachers interacting with those from other schools and with representatives from business and higher education. A business person supported the value of just being able to talk with teachers, in reflecting on the social event held for the interns and their mentors, ". . . having a drink in a nice setting after a business meeting . . . and talking to teachers is of equal or more value than a business session . . . it certainly pumps them up if nothing else." The mini-conference that will replace the symposium appears to have the potential of providing some of these similar experiences.

In another respect, the collaborative organizational structure has provided an opportunity for collective action. The business influence on the collaborative is clearly apparent in the way the subcommittees have begun to set goals and evaluate them, as reported in the evaluation report. This report reviewed activities and judged their success on the basis of the number of people who participated. This was a step toward using quantitative data to assess the effectiveness of the organization.

One form of collaboration that has not really been directly addressed and has not evolved out of the collaborative's activity is working to achieve greater cohesion among teachers in a department. The coordinator noted that this was an area where improvement could have been made. "We should have done a little more to build collegiality with each school site, such as encouraging frequent meetings and fostering collaborative meetings at least once a month at the school site." Some departments do meet regularly, but not all. In this case, collaboration has not proved contagious, something that will spread on its own, but needs to be more directed. Greater collaboration has taken place among those serving on the Teacher Leadership Council, and through internships and symposiums. But the concept has not spread to the departments. There seem to be many barriers to such collaborative initiative built into the system, such as the requirement that teachers be responsible for six classes a day, or the lack of provision for meeting time during the school day. It seems evident that collaboration has to be planned; it does not occur spontaneously.

## Professionalism

A core of from 30 to 50 teachers has, during the year, become much more involved in decision making and assertive in addressing district and state policies through their work on the Teacher Leadership Council. These and other teachers have become more aware of national trends in mathematics education and of applications of mathematics through collaborative participation. As a result, the secondary mathematics teachers are more enthusiastic about their work and their status in the community. This increase in enthusiasm has been noted by some of the business associates. One reported, "I think the [collaborative] has generated enthusiasm among a lot of teachers. . . .From that standpoint the [collaborative] has been successful." Beyond increasing enthusiasm, others note an expanding group whose members have become better informed and serve as a resource for each other and for the district.

The district administration has been impressed with the staff development opportunities that the collaborative has provided. Through these experiences the collaborative has been able to pull teachers together. The district is in the process of planning ways to build upon and take advantage of the experiences that the teachers have had. The assistant superintendent is developing a means for having teachers who attended professional enrichment activities share this information with other teachers who will work on behalf of peer support groups. She has also used the collaborative as a model for working with science teachers in preparing an application for a grant. In this way, the administration anticipates that the mathematics collaborative's influence could be extended in the district. The administration has named the director and the chair of the TLC to a committee addressing the mathematics graduation requirements in the district.

The district mathematics supervisor has noted an increase in teacher leadership activity among the mathematics teachers. She sees it in their willingness to address issues and to generate changes. She feels that the collaborative has created a larger pool of mathematics teachers from which she can choose individuals to assume leadership roles, such as giving workshops. One mathematics department chair confirms that through the collaborative she has become more assertive, "When I say to be more assertive I do not mean to have any more influence at least in my situation, but I have come up with means of organizing myself to at least let the administration know where I'm coming from. . . .Many of us have become more bold in presenting the issues and getting [the administration] to acknowledge that this is a viable issue." The collaborative has equipped teachers to take command, to take action.

The collaborative has also given teachers the opportunity to use each other as resources. One teacher reported that the collaborative had enhanced his professional life, "It has allowed me to exchange ideas with other teachers. It allowed me to go to the national teachers convention last year and I got a lot of great ideas from that." Another teacher also valued the support she has received from other teachers, ". . . the collaborative is good because we all communicate and help each other." She goes on to describe the direction they are taking, including their intention to lobby at the state capitol and to work with the elementary teachers.

During the year, empowered by the activity on the Teacher Leadership Council, teachers have become more vocal and politically active in district decisions. An overriding concern of mathematics teachers has been the state requirement that students need to pass Algebra I, Geometry, and Algebra II in order to graduate. There has been some effort to change this standard to include only Algebra I and two years of other mathematics courses. New Orleans 9th-graders have had difficulty with Algebra I because many of them have done very poorly in mathematics up to that point. One reason given for this is that mathematics is not a promotional content area in the middle grades. Students who fail mathematics in the middle grades are not given any additional help and are allowed to proceed to the next year's course. In language arts, a promotional content area, by contrast students receive remediation if they are doing poorly in the course.

In 1989-90, the TLC chose as one of its priorities making mathematics a promotional subject so that students will reach high school better prepared to take Algebra I. In March, 1990, the Orleans Parish School Board met to decide whether the district should continue to require students to pass Algebra I, Geometry, and Algebra II for graduation, or whether it should give the students a choice of which three mathematics courses they would take. The superintendent of schools favored student choice. The mathematics teachers felt that this would lower standards and would not be in the best interests of the students. At a meeting of the TLC, the group formulated its position. Then, at the School Board meeting, two collaborative teachers spoke against choice. The choice option was defeated. This was the first time that mathematics teachers had worked together to take a position and then present it to the Board. Such advocacy was very reinforcing to the teachers. The coordinator regarded the presentation as an example of how willing the teachers are now to speak up for what they believe rather than to merely accept what they are told to do. At its June meeting, the TLC spent time preparing their strategy for another presentation at the June School Board meeting.

Teachers continually spoke about the barriers in the system caused by lack of resources, by state requirements, and by the state-controlled curriculum. One teacher put it this way, "Working in a system like New Orleans is like everybody is stepping on you. It makes you think you're not an important person." She went on to indicate that being in the collaborative provided people the opportunity to share ideas and made her realize that there is help available, "It makes you feel that you're worth something again. . . you feel good again . . . you feel better about what you do." The collaborative has brought change in at least one core group of teachers who, rather than going along with the status quo, now have input into the decisions being made. As a result of learning more about mathematics and the teaching of mathematics, they support each other through sharing ideas and gaining greater knowledge about creating change. These teachers no longer complain about the system, but are identifying problems, setting priorities, and then working on solutions to the problems. There is no question but that the collaborative has made a significant impact on the professional lives of this core of teachers.

## Mathematics Focus

The mathematics focus of the collaborative can best be described as mathematics education reform. No formal focus has been adopted; rather, the emphasis has been on the professional development of teachers. Activities have ranged from having teachers become more knowledgeable about how mathematics is used in the workplace to identifying the current trends in mathematics reform as described in the NCTM

*Curriculum and Evaluation Standards*. The teachers champion issues that directly affect their students, such as taking a position on the specification of graduation and promotional requirements.

One junior high school teacher who joined the collaborative in 1989-90 teaches at a school next to a housing project. She has noted the changes in students during 20 years of teaching and the increased difficulty in getting them to learn mathematics. She described the situation, "The housing of most of our kids is deteriorating. Kids used to feel good about themselves, but now it keeps getting increasingly worse. . . .A lot of murders over there . . . a lot of drugs . . . a lot of our parents and students are addicts. At first there were maybe 5 kids out of my 150 kids and now 15 percent are involved. . . .We do pretty good on the discipline but we're losing them on the academic end. There is no reinforcement academically so a lot of kids don't make the effort." She indicates how she operates as a teacher, "I do not get satisfaction from what they do on the test. I get it from what I get from them on a daily basis. When I give them a test six months from the time they come in and they feel good about it. I have to use little steps for my reward. . . baby steps. . . ."

Several people active in the collaborative--teachers, administrators, and business associates--talked about the need to move forward in small increments. The challenge of achieving a quality mathematics program is felt by all. The collaborative is considered part of the solution. Those from business view the future needs of their companies and understand that having people with mathematical backgrounds and knowledge will be critical. Collaborative mathematics teachers understand how important it is to prepare their students for the world of work and have set high standards for their students. The collaborative has provided a forum for these teachers where they can listen to each other, join together in cooperative activity, and make a difference. The mathematics supervisor observed that "mathematics reform is catching on." There are still teachers who feel that using calculators will mentally cripple their students. There is the strong pressure from testing in the district to conform to a skills-based curriculum. There are the increasingly worsening social conditions for many of the students. But because of the collaborative, a group of mathematics teachers with the strong encouragement of those from business and higher education are working to make the mathematics education program of the highest quality--bit by bit.

## F. Next Steps

A five-day Woodrow Wilson Institute on Algebra will be held at Southern University in New Orleans from August 13 to 17, 1990. The Institute's main focus will be on new teaching methods and topics to be used in the algebra classroom. Sessions will feature applications of algebra, uses of technology, and multiple representations of data. Participants will receive instruction on a Casio fx-7000G graphing calculator and on a variety of computer software programs including *Derive*, IBM's *Mathematics Exploration Toolkit*, and *Quattro*. The district is exploring ways to introduce new ideas into the curriculum, with an emphasis on methods readily usable in the classroom. A one-day follow-up session will be scheduled during the school year.

On November 16 and 17, 1990, a mini-conference will be held at the A. B. Freeman School of Business. The conference, entitled "Mathematics Alliance Triad for Humanity," will feature Manuel Fernandez from Wayland Public Schools, Wayland, Massachusetts. The conference will be planned by teachers on the TLC. Collaborative teachers will do the presentation at most of the sessions. In addition, some sessions will be given by representatives from publishing companies, higher education, and business.

Peer support groups will be established through the auspices of the school district administration. Collaborative teachers will be identified to attend school mathematics department meetings to provide assistance in the operation of the department. The peer teachers will be paid by the school district. Two people from local universities will be employed by the collaborative to facilitate this program. These people will assume some responsibility as coordinators of the collaborative. In February, 1991, Dr. Boucree's time as coordinator will be reduced to one day each week.

A Woodrow Wilson Summer Institute on Algebra will be held the week of August 13, 1990. A total of 29 New Orleans collaborative and other teachers from the area will attend.

The Teacher Leadership Council will continue to address policy issues including teacher evaluation.

# SUMMARY REPORT:
# PHILADELPHIA MATH SCIENCE COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Philadelphia Math Science Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Philadelphia Math Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in January, 1990, and in Washington, D.C., in May, 1989; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

# PHILADELPHIA MATH SCIENCE COLLABORATIVE

## A. Purpose

The primary purposes of the Philadelphia Math Science Collaborative are to promote teacher leadership and team building and to contribute to a cohesive vision of mathematics teaching for the future. These activities are viewed as an initial step toward the goals of promoting change and empowering teachers to make needed changes.

The specific goals of the Philadelphia Math Science Collaborative are:

1. To foster communication among teachers;
2. To serve as a catalyst for innovation and change;
3. To increase teacher participation in extramural professional development programs that offer:
    a. partnerships between teachers and their colleagues in academia and industry;
    b. opportunities to enhance and improve teachers' knowledge, skills, and professionalism; and
    c. new ideas and opportunities for mathematics instruction, including integration of mathematics and the sciences, and use of calculators and computers to teach mathematics and science.

## B. Context

The School District of Philadelphia, the nation's fifth largest, serves a city of 1,647,000 people and is subdivided into seven administrative districts. Dr. Constance E. Clayton, superintendent of schools, has been in the top administrative post for seven years. There are nine school board members who are appointed by the mayor of Philadelphia for six-year terms; Herman Mattleman was the Board of Education president. The terms of three Board members expired in December, 1989. However, a special nominating committee, which reports to the mayor, did not re-nominate any of the three incumbents, choosing instead to nominate candidates from outside the current Board structure.

In April, 1990, the Board of Education adopted a series of five-year goals, including objectives to reduce the dropout rate, raise test scores, and improve student attendance. Related to achievement, the district is seeking (over a five-year period) to double the number of elementary and middle schools in which at least half of the students score at or above the 50th percentile on standardized reading and mathematics tests.

Total expenditures for the 1989-90 school year were $1,083,683,800. The projected district budget for the 1990-91 school year is $1,198,513,200. Federal funding accounts for only 1.98 percent of the total, while the state contributes 57.63 percent and local revenues make up the remaining 40.39 percent in budget expenditures. Failure to get a tax increase from the City Council in 1989 prompted a projection by the school administration of a $44,000,000 deficit in fiscal year 1991. A staggering $460,000,000 deficit at the close of 1994, not taking into consideration a new teachers' contract in 1992, was also forecast. Estimates indicate that 87 percent of the district's budget is for personnel costs and 80 percent of that figure is for teachers' salaries and fringe benefits. In late May, 1990, the City Council approved and passed a $45,000,000 package of tax increases for the School District of Philadelphia. Shortly after that Council session, the Board of Education passed its own $1,200,000,000 budget.

Desegregation is about to enter a new phase in Philadelphia as a court-mandated settlement team prepares to start an extensive investigation into what the district's voluntary policy has achieved. Pending changes in state regulations in the area of special education have assumed prominence in school planning due to the escalating number of children in special education. Nearly 30,000 children, or one in eight of the district's total enrollment, qualify as special education students and one in sixteen is deemed learning-disabled.

In July, 1989, 55 administrative jobs were eliminated as the result of a school district reorganization that was prompted by the revenue shortfall. Eighteen of the eliminated positions were in curriculum, including that of the director of mathematics. All 55 employees were reassigned to other positions in the district or retired. A supervisor was named for each of the seven K-12 school subdistricts in Philadelphia, replacing the curriculum directors. The district predicted it would save $1,500,000 as a result of the cost-cutting measures. In addition to these changes, approximately one quarter of all city schools will get new principals in September, 1990. The shifts in personnel are designed to improve educational quality.

There are 254 schools in the district: 30 senior high schools (grades 9-12); 39 middle schools (grades 6-8); 172 elementary schools (grades K-6); 4 vocational/technical (grades 9-12); and 9 special schools. Thirty-one and a half percent of all district students attended private/parochial schools in 1989-90. This is a .3 percent decrease from 1988-89. The pupil/teacher ratio in the high schools is 27:1, middle schools 27:1 and elementary 25:1.

Student enrollment in 1989-90 totaled 189,511 (49% female and 51% male). The ethnic populations for all schools are: 63 percent black; 23.3 percent white; 9.4 percent Spanish-Hispanic; 4.2 percent Asian; and .1 percent American Indian.

Students whose families were receiving AFDC numbered 77,362 and 74,015 were in government-funded lunch programs. Superintendent Clayton has ordered all high schools, beginning in the fall of 1990, to schedule lunch periods before the last period of the day, which has not only lengthened the school day, but provided a lunch period for students who previously had none. The schedule change will allow more students to take advantage of free federally-reduced lunches. Lack of a lunch program was a consequence of overcrowding which pushed schools to double shifts 20 years ago.

There were 46,629 students in the high schools, of which 1,470 students had English as a second language. At the high school level, the ethnic population was: 62 percent black; 24.3 percent white; 8 percent Spanish-Hispanic; 5.6 percent Asian; and .2 percent American Indian. In 1989-90, the student dropout rate at the high school level was 17 percent (8,683 students). Dropout rates are computed cumulatively. Fifty-seven percent of the Philadelphia graduates went on to two- or four-year academic and specialized programs or trade schools.

In 1988-89, 45,000 high school students were enrolled in mathematics, including 14,564 9th-grade students. Of those, 9,340 took algebra and 5,224 general mathematics. Only 62 percent (5,816) of the students passed algebra, and 48 percent (2,492) passed general mathematics. The State of Pennsylvania requires three years of high school mathematics for graduation, and some students take three years of general mathematics to meet this requirement.

In 1989-90, there were 9,758 teachers in Philadelphia schools (3,250 male and 6,508 female). Of a total of 2,478 high school teachers, 1,373 were male and 1,105 female. Three hundred thirty-two taught high school mathematics. The high school teacher ethnic composition was: 1,718 white; 710 black; 23 Spanish-Hispanic; 6 Asian; 1 American Indian, and 20 undeclared.

The minimum teachers' salary in 1989-90 was $22,000 for a 185-day school year, for a person with a bachelor's degree and Pennsylvania State Teaching Certificate. The average teacher salary for 1989-90 was $36,800. All high school mathematics teachers had tenure and received three paid inservice days during 1989-90.

Teachers were represented by union Local 3 AFT-AFL/CIO; the Philadelphia Federation of Teachers (PFT) is the union's bargaining agent. The current contract was approved in July, 1988, and will expire in August, 1992. That contract won teachers a 19 percent raise over four years and made changes in teacher transfer policy, use of teacher time, and overtime inequities that both the school district and union described as "landmark."

In April of 1989, Pew Charitable Trusts awarded the Philadelphia Schools Collaborative--a general purpose high school reform collaborative--a planning grant of $447,000 to study restructuring the Philadelphia schools. Teams of ten people in each school--teachers, counselors, principals and other staff--have drawn up individualized plans for the 21 schools. The overall goal for each school was to develop its own plan and to create "schools within a school," referenced as a new school-based management program. During late summer of 1989, Pew Charitable Trusts awarded the Philadelphia Schools Collaborative an $8,300,000 grant to evaluate and restructure the public high schools. Although the grant was for a three-year period, the Pew Foundation will continue to support the program if it meets its initial goals. Working in conjunction with the Philadelphia Schools on the restructuring program is the Philadelphia Schools Collaborative (PSC), a non-profit organization directed by Janis Somerville, formerly the district's executive director for planning. The creation of PSC represents an attempt to initiate major restructuring in the comprehensive high schools.

In June, 1990, Superintendent of Schools Constance E. Clayton and Philadelphia Federation of Teachers President Ted Kirsch made a joint announcement regarding an agreement that would give principals, teachers, and parents direct control over their schools via a school-based management plan. Schools will be run by 15-member councils composed of parents, faculty members, nonprofessional school staff, and administrators. Decision-making in the councils is by consensus. Michelle Fine of the University of Pennsylvania, a senior consultant to the Philadelphia Schools Collaborative, will act as project overseer. Three high schools, Overbrook, Gratz, and Olney, have been working with the Philadelphia Schools Collaborative as pilot schools in the massive restructuring project underway.

The Cigna Foundation has committed $1,500,000 to five Philadelphia schools over the next three years in an effort to upgrade the academic performance of high school graduates in the city. Program goals include teacher and other staff training, a mentoring program, and donation of equipment and supplies. Targeted schools include three elementary schools, one middle school, and one high school. Up to 20 jobs a year at Cigna will be set aside for qualified graduates of the high school and a scholarship program for other graduates will be established.

Two schools from the School District of Philadelphia received 21 Apple Computer Company "Equal Time" grants that were recently awarded nationwide. Each was written by collaborative teachers. South Philadelphia and William Penn High Schools received a total of approximately $200,000 in computer hardware and software from the $2,000,000 program. Over 2,000 schools nationwide applied for the grants.

A program developed by the Office of Education Technology and funded by a $203,000 grant from the Pennsylvania Higher Education Assistance Agency provides children from 20 public elementary schools and their families with home computers. The program, Project EACH (Equal Access to Computers at Home), provides ten portable Apple Microcomputers and software to 20 elementary schools for loan to families. Students and families may keep the computers from four to six weeks.

## PATHS/PRISM

The Philadelphia Alliance for Teaching Humanities in the Schools (PATHS) and the Philadelphia Renaissance in Science and Mathematics (PRISM) represents the nation's largest, most comprehensive public/private partnership for staff and curriculum development, serving all K-12 educators in the School District of Philadelphia. PATHS/PRISM directs more than 30 major projects in the humanities and sciences each year, including Grants to Teachers and Schools, summer institutes, colloquia and special topic symposia, and other professional enrichment programs. Since 1984, these projects have served nearly 9,000 teachers in the district.

PATHS/PRISM programs are supported by grants and contracts from national as well as local public and private sources. The sources include the Pew Charitable Trusts, the School District of Philadelphia, the Committee to Support Philadelphia Public Schools, the Rockefeller Foundation, the National Endowment for the Humanities, and the National Science Foundation. The Ford Foundation supports the Philadelphia Math Science Collaborative (PMSC), a PATHS/PRISM program. In September, 1989, the Philadelphia Mathematics Collaborative moved its offices from the Franklin Institute to the PATHS/PRISM headquarters.

A $3,700,000 grant from NSF and a $300,000 grant from Merck, Sharp and Dohme, has enabled the Comprehensive Regional Center for Minorities (CRCM) to lay a five-year foundation for increasing minority access to education and careers in science, mathematics, and engineering in the Philadelphia area. The CRCM project, one of eight nationally, is being administered through the PATHS/PRISM offices. Support components will include a computerized tracking system and a resource center.

The Philadelphia Teachers in Industry Program (PTIP) provides annual fellowship stipends for mathematics, science, and computer science teachers. To make the teachers more aware of the relationship between these academic subjects and the corporate world is a PTIP goal. Teacher recipients of the fellowships have dual responsibilities: to participate in eight weeks of corporate employment and to return to the classroom and develop a lesson plan/academic unit utilizing the summer experience. Fellowships, paid over a 10-month period, total $4,500.

High-Tech Talk, a 24-hour a day bulletin board, is operated by PATHS/PRISM and supported with funding from Bell of Pennsylvania and the Pew Charitable Trusts. The system provides information to teachers and a means of communication for the exchange of ideas among teachers.

On an elementary/middle school teacher-based level, PATHS/PRISM helped to implement a five-year plan to provide four science kits per year to all elementary classes (grades 1-6) in the district. The science kits provide year-long hands-on materials for classroom use in scientific investigation. Begun in 1985, with the contribution of resources and expertise from the Franklin Institute Science Museum, the School District of Philadelphia, and PATHS/PRISM, the program reached 63,945 students during 1989-90. In 1988, the NSF funded a Heat, Light, Motion program through PATHS/PRISM. Among the program objectives was the improvement of both the scientific and mathematics backgrounds of elementary and middle school teachers through a series of summer institutes and academic-year programs. Through a five-week interdisciplinary summer institute teachers were provided with additional materials and a deeper understanding of underlying concepts. The program was supported by a three-year NSF Teacher Enrichment Program grant.

Teacher-to-Teacher Professional Development Workshops were led by teachers who have had staff development training from PATHS/PRISM or from a similar college/university program. Workshops in science and mathematics evolved from recommendations made by PATHS/PRISM's Teachers Advisory Group, in direct response to needs expressed by classroom teachers. During the 1989-90 academic year, PATHS/PRISM funded 30 workshops, 16 in science and 14 in mathematics. In total, 620 teachers from 23 schools attended the workshops.

IBM, in cooperation with PATHS/PRISM, has conducted summer courses at IBM's regional headquarters on "Critical Thinking for a Technological World." The seminars emphasize the interconnectedness of science, mathematics, and technology. During the summer of 1990, an expanded course was to be offered to 30 teachers.

The School District of Philadelphia, PATHS/PRISM (through the CRCM), and the Philadelphia School Collaborative combined resources for the Algebra Project. Structured to introduce algebra to 8th-grade students, the program has provided in-depth staff development courses to 100 teachers since March, 1990, using University of Chicago School Mathematics Project (UCSMP) materials. Summer 1990 courses in pre-algebra will be offered for students in grades 8 and 9. Grants for new materials, textbooks, and instructional technologies will be offered to participating teachers and schools. The Algebra Project was designed to have two components. One component of the program was to better prepare middle school teachers for teaching algebra. PATHS/PRISM developed and operated a 15-week algebra course for middle school teachers. This was done through a contract with Beaver College. Over 80 teachers were scheduled to take the course during the summer of 1990 to upgrade their knowledge of algebra. The course will focus on using the UCSMP transition mathematics and algebra materials--in anticipation of Superintendent Clayton's mandate that, beginning in the fall of 1990, each school with an 8th-grade will have to offer at least one algebra course.

Another component of the Algebra Project was coordinated by Sue Stetzer, a department chair on assignment and a former collaborative coordinator. Her project targeted entering 9th-graders from four feeder schools to one high school. The targeted students were those not normally successful in algebra and those who primarily scored between the 26th and 49th percentile in standardized tests. Approximately 180 students attended classes during the summer of 1990 to increase their likelihood for success during the 9th-grade. The students were instructed by eight specially trained teachers.

The Science Teacher Enrichment Program (STEP) for secondary school teachers is also supported by the Pew Charitable Trusts. In response to the needs and interests of teachers, a five-week course in physical chemistry principles and laser application was offered during the summer of 1989 at the University of Pennsylvania. There has been an extensive academic-year follow-up program for the 26 teachers from 16 high schools who enrolled.

PATHS/PRISM offers two one-week sessions in chemistry and mathematics at the Philadelphia College of Textiles and Science each summer. During the summer of 1989, 25 secondary teachers from the School District of Philadelphia completed the mathematics and chemistry courses.

PATHS/PRISM funding has enabled PRIME (Philadelphia Regional Introduction to Minority Students to Engineering), founded in 1973, to expand its efforts to increase the enrollment of minority students in upper-level science and mathematics courses and to attract these students into mathematics, engineering, and science-related fields. In 1989, 712 students attended PRIME summer courses. Of 214 PRIME students who graduated from high school in 1990, 197 were accepted by colleges and universities. The

Comprehensive Regional Center for Minorities (CRCM) will fund additional sections of the summer program in Camden, New Jersey.

Funds from the Pew Charitable Trusts have enabled PATHS/PRISM to coordinate a program, now in its third year, offered by SmithKline and French Bio Science Laboratories. Research scientists visit classrooms in pairs and give talks illustrated by slide programs. During the 1989-90 school year, SmithKline research scientists spoke at 29 schools to over 2,000 8th-grade students.

In 1989, PATHS/PRISM awarded 144 minigrants and collaborative grants ($300 for an individual teacher's school-based project and up to $3,000 for a team of two or more teachers working together with resource people from area universities, scientific and cultural institutions, and corporations) for a total of $152,000. Program support was provided by the Pew Charitable Trusts, the Arco Chemical Company, and the Philadelphia Federation of Teachers. PATHS/PRISM awarded a total of $58,000 in grants in 1989 and $48,000 in 1988. Through their projects, many teachers have stabilized working relationships with university faculty, corporate professionals, and scientists from museums and laboratories. In 1990, PATHS/PRISM received 28 minigrant proposals as compared to 23 in 1989, 31 collaborative proposals as compared to 26 in 1989, and 33 interdisciplinary proposals.

Philadelphia was chosen by the American Association for the Advancement of Science (AAAS) as one of six national sites for Phase II of Project 2061, a long-term effort to improve the scientific literacy of the nation's students. PATHS/PRISM is the Philadelphia facilitating agency. A 25-member team (5 elementary teachers, 5 middle school teachers, 10 secondary teachers, and 5 administrators) has been selected to design a curriculum model for science, mathematics, and technology for grades K-12 in an urban setting. Work continued through the 1989-90 academic year at Drexel University where the team met four days each month. Each team member received an IBM PS2/30 computer and modem, printer, and software. The final draft of the model curriculum will be presented to AAAS by the end of June, 1991.

PATHS/PRISM is focusing on teachers and the K-8 classroom setting as sources for change, by designing interdisciplinary, school-site programs involving components of all of the above teacher-centered projects. Seven school clusters have been chosen in which all PATHS/PRISM resources will be drawn upon to assist the teachers in school renewal, in integrating curricula, and in fostering articulation among feeder schools.

**Professional Development Opportunities for Teachers**

Beaver College offered a series of colloquia for the mathematics and science community. The talks were free to teachers and held in the evenings from 7 to 9 p.m. All colloquia were held in Boyer Hall, Calhoun Amphitheatre, at Beaver College. The January 16, 1990 presentation featured mathematics, "Tricks of the Trade: A Mathemagical Slide Show." The March 13, 1990 program also featured mathematics, "Developing Thinking Skills Through Mathematical Activities, K-8." On April 24, 1990, mathematics was featured once more in a presentation entitled, "Using the History of Mathematics as a Motivating Theme."

GTE Corporation sponsored a grant program for secondary school science and mathematics teachers in 19 states, including Pennsylvania. A science teacher and mathematics teacher apply as a team for the grants. Grants range from $2,500 to $12,000 per team for professional development activities.

NASA's Educational Workshops for Mathematics, Science and Technology Teachers (NEWMAST) program gives outstanding educators in grades 7-12 an opportunity for first-hand experience with NASA's aerospace activities during a two-week workshop at a NASA regional center. The program enables teachers to bring the U.S. aerospace program back to classrooms and communities.

During National Engineers Week (February 15-24, 1990), the Delaware Valley Engineers sponsored a workshop at Temple University for mathematics and science teachers on February 22, 1990. The workshop included two sessions and a reception and dinner.

The Office of Human Resources of the School District of Philadelphia has expanded the opportunities for teachers to conduct inservice courses for fellow teachers. These activities are ideal for collaborative teachers who wish to add to their conference experiences by becoming inservice workshop presenters. An orientation workshop on how to develop an inservice course was offered by the school district in May, 1990, for interested teachers.

The Triangle Coalition is offering a fellowship program that will allow two science and two mathematics teachers to work for a year as aides in the United States House of Representatives and the Senate. Congressional Fellows will receive their academic salaries for 11 months of work with House and Senate Committees involved in science and mathematics education.

### C. Development of the Collaborative

The transfer of the operation of the Philadelphia Math Science Collaborative from the Franklin Institute to PATHS/PRISM was completed during the 1989-90 school year. Dr. Fred Stein, PATHS/PRISM director, assumed the responsibilities of the director of the collaborative. Joseph Merlino, a former mathematics teacher, was appointed the coordinator of the collaborative in October, 1989. The former collaborative director, Dr. Wayne Ransom, vice president for education at the Franklin Institute, and former collaborative coordinator, Sue Stetzer, a mathematics department head on special assignment to the school district, provided their assistance to the collaborative's new director and coordinator as called upon during the school year to complete the transition. Dr. Ransom served as co-director along with Dr. Stein.. Ms. Stetzer was a consultant to the collaborative. Staff from PATHS/PRISM had participated in collaborative activities since the 1988-89 school year in anticipation of the transfer of responsibility of the collaborative to PATHS/PRISM. During the first semester of 1989-90, Ms. Stetzer and Mr. Merlino together visited nearly all of the target schools. Mr. Merlino worked with Ms. Stetzer in coordinating the fall technology conference. Ms. Stetzer continued to edit the collaborative newsletter through December, 1990. By the end of the 1989-90 school year, the transfer of operations to PATH/PRISM was completed. Joyce Neff, a mathematics teacher at University City High School, continued to serve as the collaborative's on-site observer.

In 1989-90, seven additional high schools enrolled in the collaborative, bringing the total number of target schools to 20: Overbrook, West Philadelphia, Martin Luther King, Roxborough, Edison, and Dobbins AVT, joined in 1986-87; South Philadelphia, William

Penn, and Carver High School of Engineering and Science joined in 1987-88; Gratz, Bok AVT, Germantown, and Kensington joined in 1988-89; Audenried, Ben Franklin, Frankford, Lincoln, Saul, University City, and George Washington joined in 1989-90. Through the spring of 1989, high schools had to submit an application to become a target school; it was required that both the science and the mathematics departments express an interest in joining the Math Science Collaborative. In the past, the principal had to agree to five joint science-mathematics department meetings during the year, but this requirement was rescinded during 1988-89 because of the new district policy that affected the number of hours available for department meetings each month. The number of mathematics and science teachers in the 20 target schools totals approximately 450.

While the change in collaborative leadership was taking place, the governing structure of the collaborative under a Program Committee and a Steering Committee was retained. However, the membership on both committees changed and the balance of power between them shifted. The Program Committee, composed of department heads and teachers, assumed greater decision-making responsibility for the collaborative and the Steering Committee became less involved in decision-making and served more as an advisory group. Finally, whereas in previous years the collaborative had subsidized the membership of collaborative teachers in ATMOPAV (Association of Teachers of Mathematics of Philadelphia and Vicinity) and PSST (Philadelphia Secondary Science Teachers), this was not done during the 1989-90 school year.

### Program Planning Committee

The Program Planning Committee grew to include about 75 participants, including department heads and teachers from both science and mathematics. The committee meetings provided an opportunity for collaborative members to meet in a social context to talk about teaching and to propose improvements for mathematics and science education in Philadelphia schools. All teachers from the 20 collaborative high schools were invited to attend and participate in the committee meetings. During the 1989-90 academic school year, the group met four times as a group. Its five subcommittees held a total of 10 meetings. One task that the Program Planning Committee faced was that of developing its goals and plans for the year. By the end of the school year, the group had drafted a "Report for 1990" that listed needs and future plans.

Thirty-five teachers and department heads attended the first gathering of the Program Planning Committee at Colleen's Restaurant at 3:00 p.m., December 6, 1989. A letter was sent to each department head inviting department members to attend this reception. Mr. Merlino presented his perspective on the Program Planning Committee and indicated that all who were present qualified as members of the Committee. The group then divided into five breakout sessions for further discussion of what teachers wanted from the school district and the collaborative: mathematics/science collaborating grant applications, technology, policies, professional development/teacher empowerment, and curriculum. These groups became the five subcommittees.

On January 24, 1990, 31 teachers and department heads again met at Colleen's Restaurant from 3:00 to 5:00 p.m. A buffet dinner was served followed by a brief welcome and announcements. Then the group divided into the five subcommittees for discussion. Each subcommittee was assigned a particular direction to pursue. During the subcommittee meeting, participants were asked to define their mission, develop an agenda, identify needed outside resources to complete tasks, specify the maximum size for their group, and set the group's meeting schedule. The meeting concluded with a brief report by each subcommittee to the entire group.

The mathematics/science grants subcommittee was asked to address the question of how teachers could obtain a greater number of grants while avoiding duplicating each other's efforts and unnecessary competition. The professional development subcommittee was to develop ideas for furthering teacher professionalism and empowerment; this, however, would also entail identifying impediments to that process and what could be done to overcome these impediments. The policies subcommittee discussed identifying and formulating model school district policies that would enhance teachers' ability to teach mathematics and science and identifying existing policies that should be eliminated. The assignment of the technology committee was to develop recommendations for infusing technology into the classroom and for expanding the use of existing technology.

The third meeting of the Program Planning Committee was held on March 28, at Colleen's Restaurant from 3:00-5:00 p.m. Twenty-eight teachers and department heads attended, along with the collaborative coordinator and director. The primary focus of the meeting was on the needs of mathematics and science teachers in the district. Some of the questions raised were: What does teacher empowerment and professionalism really mean?

How do these relate to opportunities as well as responsibilities? What role should teachers have in staff and curriculum development? Recommendations and input from this group were shared with the Steering Committee at its April meeting. A list of people serving on the subcommittees was distributed and included over 50 names.

The fourth and final meeting of the year was held on May 2 at the same place and time as the other meetings. The purpose of this meeting was to establish a priority--of one to three issues--for the collaborative to pursue and to determine ways for the collaborative Program Planning Committee to establish better links with the school district administration. The 30 participants engaged in a lively discussion. The highest priority was given to the development of a teacher center. The coordinator promised to arrange a meeting with the district administration to present the group's conclusions. Comments from the teachers indicated that they valued the meeting and felt that progress was being made in having their "voices heard."

On May 16, the coordinator and codirectors met with assistants to two associate superintendents and the director of curriculum to discuss the work of the Program Planning Committee and to further communication between the district and the collaborative. The idea of a teacher center was met with some show of interest. A previous teacher center for elementary teachers had eventually closed because of lack of federal funding. The district representatives were receptive to receiving a very clear proposal from the collaborative for a teacher center; however, because the budget for 1990-91 was in the process of being finalized, it was unlikely that the teacher center proposal could be incorporated. The idea of a teacher center was continuing to be pursued at the end of the school year.

A report for 1990 was prepared by the Program Planning Committee and edited by Joe Merlino. This report was cited as the beginning of a process for teachers to set their own goals and to further the communication between them and the district. The report listed a wide variety of recommendations under six major sections: teacher professionalism, methods, professional development issues, assessing needs, curriculum issues, and policy issues regarding mathematics and science education. Some of the reported professional needs of mathematics and science teachers for improving the delivery of education included peer discussions for teachers, being kept informed of the latest trends in curriculum and technology, a library of resources (journals, videotapes, and other supporting materials), and a data base listing professional profiles of classroom teachers so that teachers in the system could locate others who use specific teaching methods or who have had certain related experiences. A teacher center was proposed to house the materials to help meet the described professional needs. The report acknowledged that professional growth of teachers is within the jurisdiction of the district. Given this constraint, the report called for release time for observing other teachers, to attend professional meetings, and to attend staff development workshops during the week; it further directed that the allotment of staff development days be districtwide. The report also recommended that the district be more open to recognizing and working with local professional organizations such as ATMOPAV and PSST, and that the specific needs of mathematics and science teachers in collaborative schools should be assessed, using a questionnaire. A sample questionnaire was appended to the report. A joint mathematics/science committee was proposed to coordinate curriculum between the two content areas. Regular communication was encouraged across grade levels. The report also recommended that students in 7th- and 8th-grade who have not mastered the basic skills required for high school be assigned to tutoring classes and that A/B scheduling (half-year scheduling) be reinstituted for mathematics and science classes. With respect to policy issues, the report recommended that teachers advise those from industry on how best to impact the school system; that class size in science laboratories be limited to 24 students; that the $50 teacher allotment be applicable to membership fees in professional organizations; that the supervising and instructional improvement roles of department heads be retained regardless of how the school is organized; that certified mathematics and science teachers be used in teaching these subjects to 7th- and 8th-grade students; and that increased incentives be studied for attracting qualified mathematics and science teachers. Of all of these recommendations, the development of a teacher center was given the highest priority by the group.

## Steering Committee

The Steering Committee, the executive body for the collaborative, was scheduled to meet about every two months. The purpose of the group is to review, advise, and promote the goals and objectives of the collaborative and the Program Planning Committee. Its 15 members include the 2 codirectors, the coordinator, the consultant, 1 higher education representative, 1 business representative, 2 district administrators, 1 union representative, 2 from other projects under the PATHS/PRISM umbrella (CRCM and PRIME), 1 school administrator, 2 department heads (1 mathematics and 1 science), and 1 teacher. During the year, the Steering Committee became more an advisory group to the Program Planning Committee and less a decision-making body for the collaborative.

Ten members attended the first Steering Committee meeting for the 1989-90 school year, which was held February 27 at the PATHS/PRISM office, beginning at 3:00 p.m. At the meeting members were introduced and a review of the history of the collaborative and its transition to PATHS/PRISM was presented. The update on collaborative activities for 1989-90 included a report on the activities of the Program Committee. The coordinator suggested to the group that one member from each of the program subcommittees become a member of the Steering Committee.

The second meeting of the Steering Committee was held on April 2 at the PECO Building starting at 3:00 p.m. The group received an update on collaborative activities and heard a report from each Program Planning subcommittee. The meeting concluded with a discussion of the role of the Steering Committee in relation to the Program Planning Committee. Based on this discussion the governance of the collaborative was reconstituted beginning in July, 1990. The Program Planning Committee felt that if teachers were to have ownership of the collaborative they had to make decisions, supported by the Steering Committee, rather than the reverse.

Seven members attended the June 4 meeting of the group, which was held again at the PECO Building. Drafts of reports from the Program Planning subcommittees had been distributed to members of the Steering Committee along with the announcement of the meeting. Members were asked for their input on possible issues, implementation strategies, priorities, and what they felt could be reasonably accomplished within the given period of time. In addition to reviewing the work of the Program Planning Committee, members wrote a purpose statement for the Steering Committee and agreed on outcomes for the collaborative. One of the codirectors remarked that the collaborative was wrestling with the next stage of its development, which included a much larger group of teachers, and that, as a consequence, the Steering Committee needed to be clear regarding its role and its readiness to address such issues as working more effectively with the district's administration.

## D. Project Activities

The Philadelphia Math Science Collaborative (PMSC) makes a concerted effort to increase teacher participation in professional development opportunities on a local, regional, and national basis. During 1989-90, the collaborative sponsored, cosponsored, and publicized a variety of professional activities for teacher participation. Pedagogical concerns, professional enrichment, and teacher leadership are examples of some areas that were explored in the various activities scheduled during the 1989-90 school year. Members of the collaborative Steering Committee and of the Program Committee, as well as collaborative Coordinator Joseph Merlino, worked individually and collectively to provide professional experiences for teachers that were both meaningful and provocative.

### Introductory Meeting

On October 16, 1989, the Philadelphia Math Science Collaborative held a 3 p.m. meeting at the Greenfield Elementary School. Teachers from all collaborative schools were invited to this introductory activity and 18 attended. The purpose of the meeting was to introduce Joseph Merlino, the new coordinator of the collaborative. In addition, teachers Shelly Berman, Phyllis Stickney, and Pat Potocney used the occasion to encourage collaborative members to attend the forthcoming regional meetings of the National Council of Teachers of Mathematics (NCTM), and the National Science Teachers Association (NSTA) meetings. Guidelines for Professional Enrichment Grants (PEGs) for the two meetings were explained.

### Mathematics, Science, and Technology Conference

The Mathematics, Science, and Technology Conference, which was held on November 4, 1989, at the George Washington Carver School of Engineering and Science, drew a total of 221 participants. The conference was sponsored by the Philadelphia School District and the PMSC of PATHS/PRISM and offered 26 workshops on topics ranging from environmental science to interactive videodiscs. Costs of the conference were underwritten by the Philadelphia School District, Apple Computers, and PATHS/PRISM.

The goal of the conference was to show teachers how they could enhance their courses and their presentation of information with the aid of technology. Conference participants included primarily teachers of secondary mathematics, science, and computer science. Some workshops demonstrated the use of software in teaching geometry and algebra. Others demonstrated the use of graphing calculators in teaching mathematics. The conference also provided an opportunity for teachers to present ideas to colleagues on their own innovative and successful approaches to teaching, using technology. Judah Schwartz, creator of the *Geometric Supposer* software and professor at both Harvard and MIT, was the keynote speaker.

All teachers from the Philadelphia area were invited to attend and enrollment was limited to a first-come, first-serve basis. Materials and handouts were distributed to participants by publishers, including classroom materials, software, and calculators.

The participants' comments on the written evaluation forms were very positive. Many of the comments encouraged the scheduling of similar conferences: "Please do it again, and again, and again." Other comments reflected the quality of the conference, "This meeting is the best-organized, most professional meeting I have attended in a year." Some teachers made suggestions regarding features of the conference that could be improved. A few felt they were too rushed and would like more time for each session, possibly holding two sessions during the day rather than three. Another participant would have liked sessions to be scheduled so that two or three sessions on the same topic could be attended. The overall impression, based on participant comments, is that the conference was very valuable to the teachers--not only did they receive new information but they gained in esteem by having a conference headlining teachers from Philadelphia. As one participant commented, "This conference showcases the ability and dedication of Philadelphia teachers."

Former collaborative coordinator Sue Stetzer shared some thoughts as well: "Shopping bags are a great idea--the publishers would willingly provide! Two two-hour workshops, with a break in between, might be a format to try. Several sessions were very rushed, this would also cut down on the cost of materials and the number of sessions needed. The best things we did were to engage the staff and students of the High School of Engineering and Science (HSES) to help us. There were lots of HSES staff involved, and that helped tremendously both in security, and in last-minute help with loose ends. This includes the 4:30 Friday afternoon realization that there were no cables for the VCR--but Sue Winston, librarian, had some and hooked everything up. The students, although not kept terribly busy, were extremely valuable as a continuous presence in each room as well as the 'gofers' who did what was needed to be done. Getting a keynote speaker to please all of the people all of the time is not possible. I think Judah was wonderful, and expected people to reach with their minds. There was some negativism about how he was too mathematically oriented--but I think it's important to stretch people. Perhaps, if there is a next year, we will look for someone who is more science oriented."

## New Schools Reception

Seven new target high schools were welcomed into the PMSC at a December 6, 1989 reception at Colleen's Restaurant. Thirty-one teachers attended the two-hour activity, which included dinner. The new schools are: Audenried, Ben Franklin, Frankford, Lincoln, Saul, University City, and George Washington. Currently 20 high schools and nearly 75 percent of all high school mathematics and science teachers in the Philadelphia School District are members of the collaborative. Dr. Fred Stein, Director of PATHS/PRISM, briefed the teachers on present and future PATHS/PRISM projects and resources. Examples of resources include PEG and PATHS/PRISM grants and the new $4,000,000 Comprehensive Regional Center for Minorities (CRCM) project which will focus on enhancing college preparation programs in mathematics and science for minorities. Sue Stetzer, former coordinator of the collaborative, spoke on her new role with the Office of Curriculum Support and the Philadelphia Schools Collaborative (PSC). In light of these new projects--the expansion of the collaborative from 13 to 20 high schools and the dismantling of the school district's Curriculum Offices--a potentially high level of impact on Philadelphia's educational direction exists.

## National Council of Teachers of Mathematics Regional Meeting

In 1989, Philadelphia hosted the National Council of Teachers of Mathematics (NCTM) Regional Conference. The collaborative tried to facilitate classroom coverage so that as many mathematics and science teachers as possible were able to attend the conference. Professional Enrichment Grants (PEGs) were made available to subsidize teachers attendance. About 60 teachers applied for and received PEGs. The grants were used to defray the cost of teacher attendance at the conference. PEG recipients were reimbursed for conference registration (at the membership rate of $28), up to $10 a day for meals, and for transportation at $.22 per mile. Approximately $3,600 was awarded in PEGs for the conference. In addition, the collaborative received a small grant from the Education Development Center (EDC) to enable the mathematics and science departments to do some follow-up after the conference.

The regional NCTM conference was held November 30-December 2, 1989, at the Adams Mark Hotel in Philadelphia. More than 4,000 teachers attended the event, including the collaborative mathematics teachers who had received the PEG grants. Teachers were not released from classrooms in Philadelphia to attend the conference, but arranged to have their classes covered so that they could go. The principals had to give permission for teachers to miss a school day to attend the meeting. Some teachers attended only after school.

"Standardizing the Future: Let it Begin Again in Philadelphia" was the theme of the conference, which offered more than 220 section meetings, minicourses, and workshops. Concurrent with the regional meeting were an administrators' conference on the NCTM *Standards*, a special student seminar for MATHCOUNTS competitors, and an evening address by Shirley Frye on "The Momentum for Mathematics," as well as five minicourses on the implementation of the *Standards*. A special science strand included workshops on integrating mathematics and science in the classroom. Social events included a reception, an excursion to the gaming casinos of Atlantic City, and a variety of tours to historic sites in Philadelphia.

At the Administrators' Seminar on Thursday, the guest speaker was John A. Dossey, past president, NCTM, Illinois State University, Normal, Illinois. His speech was entitled, "Supervising the *Standards*--a Challenge for Schools." Wanda M. White, supervisor, Fulton County Schools, Atlanta, Georgia, and David J. Glatzer, supervisor, West Orange Public Schools, West Orange, New Jersey, spoke on "The NCTM *Standards* and Staff Development: A Perfect Match." General sessions addressed topics such as: "Understanding and Implementing the K-6 *Standards*," "The NCTM *Curriculum*

*Standards*: A Vision for Mathematics Education for Urban Students," and "Changing Algebra for Changing Students' Changing Needs."

The teachers seemed to feel that the conference was very worthwhile. One teacher commented: "Speakers wonderful--amazing conference. I have no complaints." A second teacher said, "One of the best conferences I have ever attended." A third teacher remarked, "A bit crowded; I couldn't get into many of the workshops." A fourth teacher said, "This is a tribute to the local organization which had the ability to do what it set out to do." A fifth teacher concluded, "Wonderful--a wide variety of activities; lots of exhibitors--a perfectly wonderful conference." The on-site observer commented, "It was very crowded but it was a great regional conference. Very well received. Teachers really loved this conference."

**National Science Teachers Association (NSTA)**

The NSTA Regional Conference was held at The Resorts International and Showboat Hotels in Atlantic City, New Jersey, December 14-16, 1989. Featured speakers included Jeremy Rifkin, president of the Greenhouse Crisis Foundation, on "The Greenhouse Crisis," Rosalyn S. Yalow, senior medical investigator, Bronx Veterans Administration Medical Center, on "Radiation and Society," and Mario Salvadori, chairman of the board, Weidlinger Associates, on "Making Science and Math Real to Young Students." In addition there was a wide range of workshops, sectional meetings, panel discussions, and field trips. On-site registration was $45 for NSTA members and $32 for one-day registration.

PEGs were made available to help defray the costs for science teachers from target schools who attended the NSTA Regional Conference. The collaborative reimbursed 24 teachers for registration and field trip costs, up to $10 a day for meals, $.22 per mile for travel, and up to $50 for overnight accommodations. One teacher remarked, ". . . thank you for the financial support at the Atlantic City NSTA Conference. I enjoyed attending the various workshops, lectures and events . . . ."

## Follow-up Workshops for NCTM and NSTA Conferences

The collaborative received a grant from the Education Development Center (EDC) for target schools to develop programs that would enable them to engage jointly in a mathematics-science dialogue after the NCTM and NSTA regional conferences. This money was supplemented by funds from the collaborative budget. Each target school was eligible for up to $200 for materials and/or refreshments for a joint mathematics-science workshop at which teachers who had attended the conferences could share what they had learned with colleagues, both within their own disciplines and across departmental lines. Teachers were encouraged to contact collaborative Coordinator Joe Merlino for additional information on organizing the workshops.

The follow-up grants originated with the November 1989 Teacher Leadership Dinner for which the collaborative, in conjunction with PATHS/PRISM and EDC, offered grants to target schools that enabled mathematics and science teachers to share the experiences and ideas they had gained from the NCTM and NSTA regional conferences. One objective of the grant awards is to foster interaction between mathematics and science teachers. A maximum grant of $200 was made available for each school. Schools were allowed to pool their $200 to sponsor a larger affair. Items for reimbursement included food, beverages, parking, and classroom materials directly related to conference presentations. Each school's follow-up meeting, although partly social in nature, included an agenda that allowed time for substantive discussion of conference topics. Strong incentives encouraged the development of agendas that stressed the integration of mathematics and science topics or activities involving more than one school.

One teacher was designated as the principal organizer for each school. Expense money was to be paid to that person. The organizer in turn was responsible for distribution of secondary reimbursements to each school's participants.

A series of follow-up workshops was held during the winter and spring of 1990 for those who had participated in the NCTM and NSTA regional conferences--a total of 319 teachers, at 13 high schools. After one of the workshops, a teacher from Dobbins commented, "We did little but socialize but it was nice to talk with mathematics and science teachers outside of school." A second teacher added, "A wonderful dinner meeting--well organized and there were even presentations of programs that teachers had attended." The on-site observer remarked: "One teacher called me to tell me how wonderful she thought the event was. This seems like a good idea to follow up the conferences with a dinner-social event to talk about it. Those who did not attend the conference maybe will attend in the future because of the enthusiasm of others." Another group of teachers, who had held a dinner meeting, remarked: "PATHS/PRISM and its leadership has been a breath of fresh air! Thank you for sponsoring our dinner meeting." Another group of teachers commented, "We want to thank you for giving us the opportunity to participate in the dinner we had . . . it was a very worthwhile experience. The five of us, all mathematics teachers, met with a total of eleven other mathematics and science teachers. . . .and exchanged ideas that we learned at the recent professional conferences we attended. This follow-up dinner allowed us to meet with other teachers that we wouldn't ordinarily have a chance to get to know . . ." Another teacher remarked, "I have never had anything (NCTM) this exciting made available to me by any previous department head. The follow-up program was also very rewarding. Thank you for your hard work on behalf of the department."

### Models for Cooperative Learning

One hundred twenty educators attended a presentation by Dr. Uri Treisman on May 8, 1990, from 3 to 5 p.m. at the Franklin Institute. Dr. Treisman, a visiting professor at Swarthmore College, is a nationally known mathematics educator who pioneered cooperative learning strategies for minorities. His talk was titled "Models for Cooperative Learning--What Works?" All Philadelphia teachers were invited to attend this collaborative/EDC-sponsored event.

One teacher remarked: "I think it is good anytime we are communicating." A second teacher said, "It was fantastic. I am a fan of Uri Treisman. He speaks well and gives lots of information." A third teacher added, "It bothers me that he was such a seasoned speaker and has quick, canned responses to questions." A fourth teacher noted, "It was worthwhile. I really want to do more with cooperative learning in my classroom." A fifth teacher concluded, "I have been using a kind of cooperative learning at times in my class. I enjoyed hearing him speak. He was wonderful and informative." The on-site observer remarked, "Uri Treisman is absolutely wonderful. The teachers really enjoyed his talk. [Those in attendance were] enthusiastic."

## Workshops

The April 1990 newsletter announced a series of free Graphing Calculator Workshops, offered by the collaborative to begin after the public schools' spring break. For teachers who had never used a graphing calculator and wanted to learn more about them, the workshops provided instruction and training. Workshop instructors were Don Scheuer and Chuck Meiris. Times and dates were scheduled at the mutual convenience of the workshop leaders and participants. A total of seven workshops (one at each high school) was held before the end of the school year, using the Casio fx-7000 graphing calculator as a demonstration tool. The collaborative purchased ten calculators for training purposes and also paid the instructors for their teaching time.

## Grants

### Professional Enrichment Grants (PEGs)

A total of $9,000 was made available to the Philadelphia collaborative for Professional Enrichment Grants (PEGs) in amounts of up to $300 per applicant. The purpose of the grants, funded by the collaborative, was to support teacher attendance at professional conferences and workshops, and to enable teachers to consult with fellow teachers and colleagues in the private sector. A record number of 95 teachers received a total of over $6,000 in PEGs to attend either the fall/winter NCTM or the NSTA regional conferences and another 26 teachers received grants to attend the Pennsylvania Council of Teachers of Mathematics spring meeting. Additionally, grants could be received for other professional enrichment endeavors. Grant requests had to focus on the general area of professional development since other funding sources were available to develop instructional programs through PATHS/PRISM-sponsored minigrants. PEGs cannot be used to provide substitute service within a school. A request for leave to attend a conference on school time must follow established school district procedures. All mathematics and science teachers at the target schools were eligible to apply, usually 30 days before the event/meeting for which funding was requested. A review committee at PATHS/PRISM determined which applications would receive awards. The collaborative had a tentative budget of $800 per target school, which was more than sufficient to cover all requests; therefore, no one was turned down who was eligible. Consequently, the awards were ongoing in response to applications. Once a grant request was approved, the teacher was notified in writing and authorized to incur expenses up to the grant amount. While no collaborative assistance was provided for the PEGs applicants, former coordinator Sue Stetzer did provide consultation on other grants available to teachers, especially PATHS/PRISM grants. Secretarial and consultive support was made available to and used by teachers in three target schools. A total of 43 grants were awarded. One teacher who received a PEG said, "Thanks for the grant to enable me to speak in Hawaii. I look forward . . . to the Philadelphia Science Teachers Conference . . ."

In March, 1990, a new teacher workshop grants program was announced in the collaborative newsletter. The program provided for expansion of the impact of the PEGs and was designed to multiply the benefits of teachers' professional growth experiences by funding Post-Conference Workshops (PCWs). New teachers who received PEGs were offered an opportunity to give a presentation on their conference experiences to other teachers in a workshop format. PCWs provide up to $200 per workshop to cover a small presenter stipend, refreshments, and classroom materials related to conference activities.

## PATHS/PRISM Grants

Minigrants. PATHS/PRISM minigrants were made available to all full-time teachers and administrators in the School District of Philadelphia. Individuals who had directed--i.e., been listed as "Project Applicant" for two or more grant projects, provided at least one of the grants was awarded in either 1987-88 or 1988-89--were eligible for Interdisciplinary Minigrants and Collaborative Grants, Dissemination Grants, and perhaps PATHS and PRISM Collaborative Grants. The grant applications were evaluated by reviewers drawn from members of the area's education, cultural, scientific, and corporate communities, as well as postgrant recipients. These evaluations were then reviewed by a committee consisting of members of the PATHS/PRISM Board of Directors, which made final recommendations for approval by the Board as a whole. Matching funds--i.e., additional monies of up to $100 awarded by PATHS/PRISM to applicants for projects approved for funding and supported in part from another funding source or sources--were made. PATHS/PRISM matched dollar-for-dollar the first $100 of any contributions from other sources.

Collaborative Grants. PATHS/PRISM Collaborative Grants support an integrated approach to learning by providing teams of teachers and administrators with the resources to implement educational innovations. Collaborative Grant teams work together to design and implement projects that strengthen the humanities, sciences, or mathematics education. While Collaborative Grant projects may involve collaboration among several teachers within a single discipline, they offer a special opportunity for developing interdisciplinary programs. Because Collaborative Grant projects often result in new and creative approaches to instruction, they offer significant opportunities for teachers to become directly engaged in curriculum and staff development. Collaborative Grants are awarded in amounts of up to $2,500 to support projects designed to strengthen teaching in the arts, humanities, sciences, or mathematics. The eligibility for Collaborative Grants and the selection process is the same as for minigrants. Matching funds, up to $500, are awarded to applicants for projects approved for funding and supported from another funding source or sources.

Dissemination Grants. The Dissemination Grants are awarded to past minigrant project directors, past collaborative grant project directors, and collaborators on past collaborative grant projects who wish to repeat and document a previous project for dissemination to teachers throughout the school district. Teachers and administrators who have conducted projects prior to the 1988-89 school year and who have submitted appropriate documentation and evaluation of those projects as requested were eligible to receive these grants. Collaborators were also eligible to win Dissemination Grants based upon projects on which they collaborated. The two award categories are minigrant and collaborative grant, awarded by the same process as the Minigrants and Collaborative Grants. A June 15, 1990 deadline was established for completion of projects in the Dissemination Grant award process.

Ten of the 49 recipients of PATHS/PRISM grants awarded during 1989-90 were from collaborative schools. Grant applications from collaborative schools had an 83 percent acceptance rate.

## Regional and National Conferences

### Woodrow Wilson Chemistry Institute and Follow-Up Workshop

A Woodrow Wilson Chemistry Institute was held August 7-11, 1989, at the Philadelphia College of Textiles and Science for high school chemistry teachers. One collaborative teacher attended the workshop. The Institute provided an intensive introduction to the operation of a high school laboratory program on a microscale (small laboratory scale), as well as presentations that focused on methods and techniques for successful chemistry teaching. Four Master Teachers, who participated in a four-week Summer Institute on High School Chemistry held at Princeton University under the direction of the Woodrow Wilson National Fellowship Foundation, conducted the Institute. Institute Master Teacher Leaders were: George Gross of Union High School, Union, New Jersey; Robert Lewis of Downers Grove North High School, Downers Grove, Illinois; John Little, St. Mary's High School, Stockton, California; and James Tarnowski, Avon High School, Indianapolis, Indiana. Institute funding, fees, eligibility, credit requirements and post-workshop grants were the same as those listed for the Woodrow Wilson Mathematics Institute on Geometry.

Master Teacher George Gross conducted a follow-up microscale chemistry workshop on Saturday, March 3, 1990, from 9 a.m. to 2 p.m. at the College of Textiles and Science. Mr. Gross assisted participants in conversion of their current chemistry laboratories to microscale. All chemistry teachers were invited to attend the follow-up session.

### Woodrow Wilson Institute on Geometry and Follow-Up Workshop

Thirteen mathematics teachers representing eleven Philadelphia high schools were selected to attend the Woodrow Wilson Institute on Geometry held August 14-18, 1989, at the Philadelphia College of Textiles and Sciences. Lincoln High School and George Washington High School, new collaborative schools in 1989-90, each sent a participant to the program. Primary funding for the Institute was provided by the Woodrow Wilson Foundation, through a Pew Charitable Trusts grant. Each teacher was awarded a $100 stipend toward the $125 registration fee by PATHS/PRISM. Guest speakers were: Glenn Bruckhart of Littleton, Colorado; Lew Douglas of Oakland, California; Barbara Rockow of the Bronx, New York; and Rosemary Wyche, Chicago, Illinois. The speakers qualified as Master Teachers, having participated in a month-long Summer Institute on High School Mathematics held at Princeton University under the direction of the Woodrow Wilson National Fellowship Foundation. The week-long Institute presented new directions in the content and teaching of high school geometry. One focus was to provide secondary school teachers the information and motivation necessary to make geometry classes more productive, exciting, engaging, and realistic for their students. Teacher participants were invited to experiment with manipulatives and software, to critically review existing curriculum, and to generate extensive amounts of material designed for immediate use in the classroom. There were open discussions and the opportunity for participants to share materials and activities that they had found successful in their own teaching.

Participant teachers were eligible if they were under contract for the 1989-90 school year; enrollment was limited to the first 32 qualified teachers who registered. The registration fee was $125 and covered lunch and coffee for the length of the Institute, as well as all materials. In addition to the $100 stipend, teachers were eligible for an additional $200 grant from PATHS/PRISM if they were willing to share their Institute experiences with colleagues during the academic year. Graduate credit was available through the Philadelphia College of Textiles and Science.

On March 3, 1990, from 9 a.m. to 1 p.m., Master Teacher Glenn Bruckhart returned to the Philadelphia College of Textiles and Science to lead a follow-up workshop on strategies and activities for teaching geometry. Mr. Bruckhart introduced new ideas for use in the geometry classroom and discussed the application of activities presented during the previous summer. Teachers who had participated in the Woodrow Wilson workshop were given an opportunity to discuss their experiences in using the material presented during the summer, although all mathematics teachers were invited to attend.

### Project EXCELS

In spring, 1989, six Philadelphia teachers (five from the collaborative) were selected by Indiana University of Pennsylvania to participate in an NSF-supported program, Project EXCELS (Expansion of Computer Education in Learning the Sciences). As part of the project, the teachers attended a three-week program at Indiana University during the summer of 1989 on the use of computer technology in the mathematics classroom. As a follow-up, Indiana University faculty and the team of six teachers provided workshops in Philadelphia at South Philadelphia High School on January 20 and again on February 10, 1990. The workshops, open to all teachers of mathematics and science, were limited to 15 mathematics and 15 science teachers. Teachers who attended the workshops received a $50 stipend for each session and lunch. The workshops were conducted by teachers from six schools: Overbrook, Roxborough, South Philadelphia, Martin Luther King, Strawberry Mansion, and Northeast High Schools. Edna Barnes of Overbrook, Fred Pierce of Roxborough, and Sam Williams of South Philadelphia High School conducted science workshops that invited hands-on investigation of science experiments, including use of the electrocardiogram, voice prints, diffusion, and supercooling curves. Christinia Frazier of Northeast, Nancy Bialon of King, and Claude Crocker of Strawberry Mansion conducted mathematics workshops that ranged from middle school problem solving through geometry, logic, data analysis, and trigonometry-calculus. These sessions demonstrated ways in which to incorporate software into the curriculum.

Topics for the mathematics sessions included: Higher-Level Problem Solving, a workshop that focused both on general mathematics and Mathematics In Applications (MIA), as well as on demonstrating software that allowed students to think for themselves; Geometry, a workshop that demonstrated ways of enhancing the teaching of geometry by using the computer as a tool; Problem Solving, a workshop that presented strategies for using mathematics software and was designed to familiarize participants both with some of the new software available for teaching mathematics to middle school students using the *Standards* as a guide and with the development of lesson plans incorporating specific software into the standardized curriculum. The Logic workshop focused on logic in the middle school; Data Analysis focused on the wide use of statistics and the data that produce statistics, making a point of helping students develop data analysis skills. This workshop also explored ways to incorporate data analysis into the curriculum for grades 8-12. The Trigonometry-Calculus workshop put emphasis on allowing adequate time for students to walk through problems in order to make their own discoveries.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

Three secondary mathematics teachers represented the Philadelphia Math Science Collaborative at the workshop. EDC had agreed to sponsor two teachers from each collaborative, paying for room, board, registration and transportation; the third teacher was funded by the collaborative.

## ATMOPAV Meetings

Founded over 40 years ago, ATMOPAV (Association of Teachers of Mathematics of Philadelphia and Vicinity) is an organization of more than 1,000 mathematics educators who are dedicated to improving mathematics instruction at every level from kindergarten through college. Membership extends to the five-county Philadelphia area. ATMOPAV holds three professional meetings each year; the Fall Meeting, the Winter Meeting, and a Spring Banquet. A newsletter is published three times a year. ATMOPAV is an affiliate of the Pennsylvania Council of Teachers of Mathematics (PCTM) and the National Council of Teachers of Mathematics (NCTM). Dues are $6.00 per academic year.

Fall Meeting. Gloria Dion, co-chair of the Membership Growth Committee, sent a letter in September, 1989, to all mathematics teachers in the Delaware Valley. The letter included a flyer and membership information for ATMOPAV and highlighted the events for the 1989 Fall Meeting, scheduled for Saturday, December 2, in conjunction with the National Council of Teachers of Mathematics Regional Meeting at the Adams Mark Hotel.

An ATMOPAV closing session during lunchtime featured Paul A. Foerster whose address was titled, "Creating Good Problems: An Art and a Science." The annual ATMOPAV business meeting and election was also a part of the Saturday agenda. Former collaborative coordinator Sue Stetzer was nominated as newsletter editor and Joyce Neff, also of the collaborative, was nominated to the Executive Board with one additional year to serve.

Winter Meeting. ATMOPAV held its Winter Meeting on February 3, 1990, at St. Huberts High School. Dr. Philip Reynolds of Niskayuna High School, New York, the keynote speaker, presented an address titled "The Transformation of Joe Teacher--A Reflection on What Future Awaits This Standards Bearer." Two hundred twenty teachers attended the meeting; several collaborative teachers, non-collaborative teachers, and members of ATMOPAV comprised the audience. Fourteen commercial exhibitors displayed materials in the cafeteria. In addition to the four sessions and two workshops, a mathematics student competition was held.

One teacher remarked: "It is as always, a wonderful winter event." A second teacher said, "Having the math contest is wonderful. I brought a team from my school and it was good for them to see the teachers involved in workshops." A third teacher commented, "I find the networking and talking to my colleagues as important as attending the sessions." A fourth teacher offered, "I think there is too much at the same time. They are not well attended because there is too much--why don't we have just two or three sessions." A fifth teacher added, "I think it would be better to do what we used to do for winter meetings--have three speakers who are real drawing cards--experts in their fields and we'd probably have a better showing." The on-site observer added, "There seem to be fewer exhibitors--but that may be because there are fewer publishers. The winter meeting is never well attended and over 200 is fairly good. Some people enjoy coming to conferences and will always come and some will complain. It was a good conference. Speaker was good but sparsely attended."

Spring Banquet. ATMOPAV sponsored a spring banquet on May 10, 1990, at Williamson's Restaurant. It began with registration and hors d'oeuvres at 5:30 p.m., followed by dinner and the program at 6:30 for the 75 educators in attendance. Patricia Overdeer spoke on "Geometric Concepts in Islamic Art." The topic was focused on Islamic design as an elegant example of the "cold and austere" mathematical beauty of which philosopher Bertrand Russell wrote. Cultural and conceptual foundations of art and geometry in the Muslim world were revealed during the presentation. Various tesselated patterns, often seen in Islamic art, were reproduced on the cover and interior of the banquet's printed program.

The collaborative paid for four of its members' dinners on the condition (specified by the coordinator) that they join ATMOPAV. One teacher said, "Wonderful banquet. As always it was nice being with other math teachers." A second teacher remarked, "Interesting speaker. I was very happy to attend the ATMOPAV closing banquet." A third teacher added, "Before the collaborative paid my membership, I had not been to an ATMOPAV meeting. It was an interesting evening." A fourth teacher commented, "Speaker was a little long but it was better than the speaker two years ago."

## Fall Conference of the Philadelphia Secondary Science Teachers (PSST)

The Philadelphia Secondary Science Teachers (PSST) held their Fall Conference on October 12, 1989, at the Philadelphia College of Textiles and Science, Downs Hall. The conference began at 2:30 p.m. and broke for dinner at 6:30. Keynote speaker H. George Hamilton, of the Franklin Institute, spoke on "New Opportunities and Challenges for Science Teachers at the Franklin Science Institute." One of the highlights of the conference was an Enrichment Program Panel featuring Roland H. Johnson, program director of the William Penn Foundation; Dr. Alexander Tobin, PRIME; and Carl Brehmer, the Parkway Program. Mr. Johnson discussed summer enrichment programs in mathematics and science at eight colleges and universities for average 9th- and 10th-grade public school students. Programs being offered are both residential and commuter. Dr. Tobin spoke on the non-profit corporation devoted to creating opportunities for minorities in engineering, pharmacy, and other mathematics- and science-based professions. PRIME offers programs to junior and senior high school students in the Greater Philadelphia area. Brehmer announced opportunities for top students in the country in Summer Science enrichment programs with available scholarship money.

## New England Mathematics Conference (NEMC)

The Philadelphia Math Science Collaborative was invited to lead a workshop on teacher professionalism at the New England Mathematics Conference held in Portland, Maine, November 18, 1989.

Dobbins mathematics teacher Pat Potocney and collaborative Coordinator Joe Merlino joined EDC's Grace Kelemanik in speaking about the issues and challenges of enhancing teacher professionalism before a room overflowing with New England teachers. One of the key issues discussed was how to promote professionalism within the constraints of a system that provides very little professional leave time.

## The Pennsylvania Council of Teachers of Mathematics Conference

Five collaborative mathematics teachers attended the Pennsylvania Council of Teachers of Mathematics Conference supported by Professional Enrichment Grants (PEGs). The conference was held in Harrisburg, March 8-10, 1990. Teacher participant Sarah Poncz of Roxborough organized a post-conference workshop entitled, "Calculators Are Here to Stay--Are You Ready?" The workshop was held on April 14, 1990, from 2:30 to 4:30 p.m. at Roxborough High School. Five teachers participated and received a scientific calculator. The post-PEG workshops are a new collaborative initiative designed to build upon the conference experiences of teachers who have been supported with PEGs. Up to $200 is budgeted for teachers to prepare and present a post-conference workshop for their fellow teachers.

## National Science Teachers Association Convention

Six science teachers from collaborative schools attended the National Science Teachers Association Convention in Atlanta, Georgia, April 5-8, 1990. All six teachers received PEGs to defray their expenses. Each teacher offered a post-conference workshop which focused on topics discussed at the convention.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Only Joyce Neff, the on-site observer who received funding from the UMC Documentation Project, attended the 68th Annual Meeting of NCTM in Salt Lake City. The theme of the NCTM conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened to seek new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, whose address was entitled, "Students of Color Through Staff Development."

## Collaborative Newsletter and Calendar

The PMSC publishes *The Philadelphia Math/Science Collaborative Newsletter*, a monthly newsletter and calendar to keep teachers informed of upcoming events, i.e., professional conferences and workshops, and collaborative and school district programs for teachers. The newsletter is circulated to approximately 650 mathematics and science teachers, department heads, supervisors, principals, district administrators, and other interested individuals and groups outside the district. Sue Stetzer edited the newsletter in the fall. A PATHS/PRISM staff person took over responsibility for the newsletter beginning in 1990.

**Hi-Tech Talk Computer Link**

PATHS/PRISM supports an electronic bulletin board system that is available to all teachers who have a computer and modem. Once logged on the board, a variety of message boards for various disciplines and grade levels are accessible. The system has electronic mail capability and has been programmed for the procedure of uploading/downloading files by computer type.

## E. Observations

### Project Management

The transfer of responsibility for the collaborative from the Franklin Institute to PATHS/PRISM and the change in coordinators have had an effect on the operation of the collaborative. To a significant extent, these changes are reflective of the differences in the two host organizations and the mode of operation of the two coordinators. The collaborative was unique among the programs operated through the Franklin Institute. Whereas the Franklin Institute oriented its efforts toward programs for students, both within the museum and as outreach, the collaborative targeted teachers and professionalism. Thus, the collaborative was on the periphery of the Franklin Institute's mission and consequently held a special status. Because it was one of a kind, there were very few constraints on how it developed. This situation seemed advantageous in the collaborative's formative years.

On the other hand, the collaborative's mission to develop teacher professionalism matches closely the mission of PATHS/PRISM. In coming under the PATHS/PRISM umbrella, the collaborative joined other programs whose purposes are akin to that of the collaborative. As such, the collaborative lost its only-child status and has become one of several programs, all with their own unique worth, vying for the attention of the PATHS/PRISM administration. If the collaborative was to become institutionalized, PATHS/PRISM was the most appropriate host agency because of its wide sources of funding, its ability to provide administrative services, and its capability for coordination with other programs. Toward the end of the school year the collaborative operation was distributed among other PATHS/PRISM staff. In this way one staff member has responsibility for the collaborative newsletter, another prepares materials in preparation for the collaborative meetings, and a third works with the grants and professional development workshop. Mr. Merlino has retained responsibility as the coordinator, but he networks with other staff members.

In addition to the change in the host agency, the change in coordinators has resulted in differences in the operation of the collaborative. Ms. Stetzer developed the concept of in-school collaborator very successfully. She was able to accomplish this because of her experience within the district, her service as a department head, and her perseverance. The in-school collaborator approach was very effective in introducing departments to the collaborative and in involving teachers actively in collaborative activity as a means of meeting their needs. The personal attention given departments and teachers required spending a considerable amount of time in schools and less in strategic planning. The in-school collaborator approach made it difficult to expand beyond a dozen schools. However, this problem was being overcome somewhat as department heads of the longer standing collaborative schools assumed more of the responsibilities of the in-school collaborator. The approach was heavily dependent on one person and was difficult to duplicate. Although there was input into the management of the collaborative by the Program Planning Committee and the Steering Committee, these groups primarily served as advisory groups to the coordinator and as a means of communication with collaborative teachers.

The new coordinator, Joseph Merlino, became essentially a program manager. He inherited a collaborative that had been expanded to 20 schools. He came from outside of the district and had to become acquainted with the mathematics program and with the teachers. His approach was to facilitate the process by which teachers became the major decision makers for the collaborative through the Program Planning Committee. After he made a visit to most of the schools to meet the teachers, all collaborative teachers were invited to attend a dinner/discussion reception. Those who attended and were willing to continue became the Program Planning Committee. The positive response to this group can be at least partially attributed to the work of the in-school collaborator in the previous years. Those teachers who have served on the committee felt positive about the process of its formation and are aware that they are having an input into planning. The Steering

Committee, formed after the Program Planning Committee, has assumed the role of confirming the action of the Program Planning Committee.

Reflecting on the development of collaborative management over the years, the in-school collaborator concept was artfully executed, but could only reach out to a limited number of schools. Built into its approach were the strong connections within the existing system, as well as pressure to retain the existing structure with department heads playing a very dominant role. PATHS/PRISM became more involved in the collaborative during the transition year, 1988-89. Although some difficulties (in the change in personnel) were experienced in the transition, programming went well with programs such as the Technology Conference, PEGs, and the newsletter continuing. The shift to opening the decision-making process to the collaborative provides greater input into the process on the part of teachers. There is still significant input from the department heads, but more teachers are actively engaged in planning. A potential problem in the scheme is that the management of the collaborative might become too defused so that no one person is accountable. For now the coordinator has manager responsibility. What is evident in Philadelphia is that the nature of the collaborative has been heavily dependent on the personality of the coordinator. This is different from other collaboratives, such as Cleveland, that have undergone many changes in coordinators without a direct impact on the direction of the collaborative.

## Collaboration

The Program Planning Committee provided the central forum for collaboration during the 1989-90 school year. Through this group and its five subcommittees, mathematics and science teachers worked together to plan for the collaborative. These groups wrestled with defining needs and planning a course of action to serve the mathematics and science teachers in the district. In part, this form of collaboration had a social objective: to provide an opportunity for teachers to get to know each other. In part, it was an attempt to produce a program that could effect change in the schools.

Another form of collaboration across the two disciplines was the within-school interaction between the mathematics and science departments. In previous years, one requirement for teacher members of the collaborative was that during the school year they would participate in five joint meetings of the two departments. This condition was not always met and in 1989-90 was ignored--one of the main reasons being that departments had difficulty in finding a common meeting time for their teachers.

The fall technology conference was another collaborative event that brought teachers together from different content areas. This gave mathematics and science teachers the opportunity to hear presentations by teachers from each of the disciplines as well as presentations by some social studies teachers. It was informative for participants to learn from other teachers how they employed technology in their classrooms. One social studies teacher had access via a modem to bulletin boards in this country and in Europe. He would draw from these resources during class time and have students communicate with people in other countries. As a consequence of the collaborative's emphasis on the interaction of teachers in science and mathematics with each other, teachers have identified as one important outcome of the collaborative the dialogue that has been generated among teachers from the two fields. One teacher noted that mathematics and science teachers are more united than they were prior to the existence of the collaborative.

There was some interaction between teachers and those in higher education during 1989-90, as exemplified by the presentation Uri Triesman made to the collaborative. He was attempting to create a network of people in higher education who would provide support to public schools. This has for the most part not evolved, although one teacher used materials she had received from the Algebra Project developed by a college professor from New Jersey. The Philadelphia area did offer opportunities for teachers to interact with those from higher education by attending the Beaver College Colloquiums or the workshops provided by professors from Indiana University of Pennsylvania. However, there were no collaborative-sponsored activities to bring representatives from business and industry together with teachers. Teachers do have internships available to them from other sources. One business representative and one higher education representative serve on the Steering Committee. There also was some interaction between teachers and those from higher education through the minigrants. PATHS/PRISM itself is well connected with higher education and business, having evolved with the support of people from these sectors.

In this year of transition and adjustment, collaboration primarily occurred among the teachers involved with the planning process. The 1990 Program Planning Committee

Report noted that some consideration was given to the interaction between industry and the schools. This was a reference to a mechanism by which teachers could be used as consultants in industry on how it can best impact on the schools. Again, however, the interaction tends to be one way, and does not promise true collaboration. One problem with teachers planning among themselves is they generally do not think of new forms of interaction that could prove beneficial. As has been observed in other collaboratives, if those from higher education and business are to be significant partners in collaborative activity of any kind, they need to be included from the beginning as equal participants. While teachers have benefited from working with each other, it appears that there is little potential or interest in bringing in those from business and higher education other than as resources for funding, or as speakers.

### Professionalism

The main contribution of the collaborative to professional development, as noted by teachers, has been that of the professional development grants. Teachers have used these to attend professional meetings that they would not otherwise have attended. This was evident in the number of mathematics and science teachers who attended the regional meetings of their professional organizations. As a result of being at these and other meetings, teachers report an increase in their awareness of current trends in their area and a greater enthusiasm for teaching. To increase the impact still further, teachers were able to get follow-up grants for materials and/or refreshments to do a workshop for teachers from their school.

In the 1989-90 school year, the change in coordinators created a break with the previous year. Whereas in the past the in-school collaborator had provided individual support to teachers and encouraged them to write proposals or attend workshops, during this year the support existed more among the teachers themselves. The impact of the in-school collaborator was clearly evident. One science teacher reported success in obtaining grant funds to acquire computers for her school and equip the science laboratory. She credits Ms. Stetzer with encouraging her and helping her write her first proposal, which gave her experience and interest in seeking additional grants. Other teachers profited from professional activities they had learned about through the collaborative and had been encouraged to attend. Some of these teachers had been given the opportunity such as that presented by the Technology Conference to present their own workshops. This added to their confidence. One teacher was explicit on how the collaborative had affected his development of leadership qualities, "I've been continually encouraged to (develop) my own skills and to offer my support to other teachers."

With this preparation and background, those mathematics and science teachers who served on the Program Planning Committee were well prepared to discuss ideas with each other and to start developing plans. Currently, the approach of the collaborative is to encourage the teachers in providing leadership. One teacher indicated that she is doing this through giving workshops, urging teachers to teach different courses, to use computers, to apply for grants, and to conduct workshops. She has invited teaches to observe her class.

The view that collaborative members have of teachers as professionals reflects the contributions of the collaborative and the teachers' own increased professional activity. One teacher defines a professional as one who takes what he or she does seriously, is active in pursuing knowledge about the why and how, and is interested in sharing this knowledge with others. Another teacher views a professional as someone who knows the content, who knows what is going on in the field, who is willing to expand his or her knowledge, and who asks questions. Both of these descriptions portray teachers who have been active in the collaborative and who are now being looked up to for the contribution they can make to the direction of the collaborative.

## Mathematics Focus

One main theme for the Philadelphia Math Science Collaborative has been technology. The Technology Conference is a major vehicle for exploring this theme and increasing teachers' knowledge of technology. What is critical about the conference is that teachers are the presenters and talk about what they actually do in their classrooms. Those who attend the conference see software demonstrated and then are given copies to take back with them to be used with their students. In the process of learning more about technology, the conference provides teachers with opportunities to understand the implications of technology in terms of what students need to know about mathematics. For example, the keynote speaker argued for a visual approach to teaching algebra that can be supported with computers. Another teacher noted that it is important for students to be actively engaged in learning mathematics through computers. To do this, students need to work in a computer laboratory where only one or two can be on a computer.

## F. Next Steps

Several enrichment activities are available for collaborative teachers during the summer of 1990 as well as during the 1990-91 school year. An institute on Brain and Behavior, sponsored by PATHS/PRISM and Bryn Mawr College, will take place July 8-20, 1990. IBM will sponsor a summer institute on Critical Thinking for a Technological World August 6-17, 1990. During the summer of 1990, courses will be offered on the University of Pennsylvania campus to update secondary teachers in the areas of lasers and materials science. Courses run from July 2 through August 2, 1990. The 1990 Pennsylvania Department of Education Curriculum and Instruction Conference, comprised of 52 workshops, is scheduled July 31-August 3, 1990, on the Shippensburg University Campus. PATHS/PRISM and the Philadelphia College of Textiles and Science will host a Woodrow Wilson Institute August 13-17, 1990, for teachers of secondary school mathematics and teachers of chemistry. Algebra will be the mathematical focus. The Woodrow Wilson Fellowship Foundation will also present an Institute for Teachers of Secondary School Mathematics August 6-10, 1990, at the Rutgers University campus in Camden, New Jersey. Two teachers will be sponsored by the Philadelphia collaborative to attend the UMC Teacher Leadership Workshop in New Hampshire the week of August 4-11, 1990.

Secondary Mathematics and Science Teachers in Philadelphia will have the opportunity to attend a variety of conferences. NCTM will hold its only eastern regional conference for 1990 in Parsippany, New Jersey, October 18-20, 1990; the conference theme is Mathematics Through Talking, Touching and Thinking. PSST will present its fifth annual Fall Conference on November 1, 1990, at the Philadelphia College of Textiles and Science from 3 to 7:30 p.m. In addition, PATHS/PRISM continues to sponsor a cost-free course-auditing program for teachers who have participated in a program, grant, or institute. The annual Mathematics, Science, and Technology Conference, which will be coordinated by Sue Stetzer, will be held on December 1, 1990.

At the conclusion of the 1989-90 school year, 20 schools were part of the collaborative; that number will increase by three during the 1990-91 school year. The long range goal is to have all 34 Philadelphia high schools in the collaborative. The collaborative will continue to work closely with teachers in their own schools. The in-school component is focusing on teacher empowerment and the collaborative will continue to build on the emerging teacher leadership. Speakers, computer workshops, and joint mathematics/science meetings will be held in each school on topics identified by the teachers.

Several Pennsylvania teachers will receive fellowships in the 1990-91 school year, for a total amount of $21,229, through the U.S. Department of Education's Christa McAuliffe Program. Fellowships are used for educational projects, consultation, program development, model teacher programs, and staff development.

A new program administered by PATHS/PRISM and developed by high school teachers in coordination with the American Chemical Society is ChemCom (Chemistry in the Community), which will be piloted in 1990-91. Teacher participants will receive funds for staff development and laboratory equipment and a discount on ChemCom textbooks. The work of other PATHS/PRISM projects, such as the Comprehensive Regional Center for Minorities, the AAAS 2061 Project, and the Algebra Project, will continue.

# SUMMARY REPORT:
# PITTSBURGH MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Pittsburgh Mathematics Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Pittsburgh Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district; and two site visits by the staff of the Documentation Project.

# PITTSBURGH MATHEMATICS COLLABORATIVE

## A. Purpose

Six goals articulated in the initial proposal of the Pittsburgh Mathematics Collaborative continue to provide its focus. The project's goals are:

1. To overcome teachers' isolation and to increase opportunities for interaction;
2. To educate the community about the professional nature of high school mathematics teachers;
3. To enhance teachers' knowledge base of mathematics and its applications;
4. To provide opportunities for professional self-enhancement;
5. To provide opportunities for teacher recognition; and
6. To provide time for teacher interaction, work, and professional development.

The long-range goal of the collaborative, as stated in the 1986 proposal for continued funding, is the institutionalization of a set of structures and processes that will continuously foster teacher professionalism and will be decreasingly reliant on external administration and facilitation. In light of this goal, collaborative activities were guided by a vision that by the close of the 1989-90 school year, Pittsburgh would have:

1. An energized secondary mathematics faculty, deeply involved in mathematics curricular and policy issues, and continuously interacting with the broader mathematics community;
2. A community that is knowledgeable about secondary mathematics issues and appreciative of secondary teachers;
3. A series of mechanisms in place to promote exchange and interaction among teachers and community leaders in business, industry, and higher education; and
4. A public more aware of the importance of mathematics in students' educational development and in adults' professional lives.

## B. Context

The City of Pittsburgh covers a 55.5 square-mile area and has a population of 385,000. In a region where heavy industry traditionally dominated the economic balance, Pittsburgh is slowly developing as a cultural and high-technology oasis. A large project, scheduled to open in 1991, is the Carnegie Science Center which is located on the riverfront adjacent to Three Rivers Stadium. The $37,000,000, 146,000 square-foot complex will feature an Omnimax Theater, the Henry Buhl, Jr., Planetarium, an auditorium, museum shop, riverfront restaurant, and 40,000 square feet of exhibit galleries. The new Center's marketing manager, Jo McKee, remarked that a distressing decline of interest in science among young people has created a responsive direction for the Center to provide an educational/scientific program series. Renovation of an old brewery complex provided space for new high-technology firms like Vortex and Data Communication Corporation. Both firms have created service-directed software, one for personal computers and the other for the medical field. As an additional cultural contribution to the community, the Volkwein building on the city's north side is being prepared to house the Andy Warhol art collection in the near future.

In December, 1989, the Pittsburgh region sustained a 5.2 percent unemployment rate, which reflected the State of Pennsylvania unemployment rate for the same time period.

The Pittsburgh Public School (PPS) Board has nine elected members. Dr. Richard C. Wallace, Jr., is superintendent of schools and has served in the top administrative position for ten years. During 1989, Dr. Wallace signed a new district contract which expires in August, 1993. His annual salary is $89,000. Dr. Wallace is assisted by one deputy superintendent and three associate superintendents. The Division of Mathematics, one of 13 divisions within the Department of Curriculum and Program Management, is under the direction of Dr. Diane Briars. The Division of Mathematics has five supervisors who monitor the K-12 mathematics program.

The 1989 calendar year budget for Pittsburgh Public Schools (PPS) was $290,850,000 and the 1990 budget was $313,645,000. Established funding sources are (1) the state at 34 percent of the budget, (2) local revenues at 57 percent, and (3) other sources of funding at 9 percent. The Pittsburgh school district has 84 schools--11 senior high schools (grades 9-12); 14 middle schools (grades 6-8); 51 elementary schools (grades K-5); and 8 special schools with various grade levels. Twenty-six percent of the students in the district attended private or parochial schools during the 1989-90 school year; this percentage has remained constant during the past two years.

Of a total school population of 38,885, 11,657 attend high school, 7,976 attend middle school, and 19,252 attend elementary school. Approximately 19,900 students are male and 19,000 are female. In the high schools there are 5,876 males and 5,781 females. PPS uses two ethnic categories, African-American and other. The ethnic population distribution in the high schools is: other males, 3,118 (27%); other females, 2,939 (25%); African-American males, 2,758 (24%); African-American females 2,842 (24%). At the middle school level, there are 4,096 males and 3,880 females. Middle school ethnic populations are: other males, 1,921 (24%); other females, 1,749 (22%); African-American males, 2,175 (27%); and African-American females, 2,131 (27%). Only 175 students across all grades are classified as English-as-a-Second Language (ESL) students. Thirty-six percent (13,926) of the students are from families who receive AFDC and have one or more children in school and 50 percent (19,562) of the students participate in the government-funded lunch program.

Pittsburgh schools had a 23 percent dropout rate in 1989-90, which was calculated as a four-year comprehensive rate and projects the percentage of 9th-graders who are not expected to graduate.

During the previous school year, 1988-89, 10,550 (86%) of all high school students were enrolled in mathematics courses. Three years of high school mathematics are required for high school graduation in the State of Pennsylvania.

Norm-referenced standardized tests were not administered in 1988-89 to Pittsburgh high school students. Thus, no norm-referenced standardized test results for high school students were reported in 1989-90. Students in grades 1-8 in 1988-89 were administered the California Achievement Test (1985 edition) in May, 1989. A total of 51 percent of Pittsburgh students in grades 6-8 scored above the national norm, a decrease from the proportion of 56 percent the previous year. A total of 61 percent of Pittsburgh students in grades 1-5 scored above the national norm, an increase from the proportion of 59 percent the previous year.

PPS employs 2,779 teachers: 985 (520 males and 465 females) teach in the high schools; 720 (310 males and 410 females) teach in the middle schools; and 1,074 (175 males and 899 females) teach in the elementary schools. The ethnic population of teachers in the high schools consist of: 474 white males (48%), 367 white females (37%), 44 black males (4%), 97 black females (10%). At the middle school level, the teacher population is: 266 white males (37%), 294 white females (41%), 43 black males (6%), and 110 black females (15%). Less than one percent of high school teachers (3) and of middle school teachers (6) come from other underrepresented groups.

Mathematics teachers in the high schools total 104, of which 63 are male and 41 are female. Among mathematics teachers, 60 are white males (58%), 33 are white females (32%), 2 are black males (2%), 8 are black females (8%), and 1 is an Hispanic male. In middle schools there are 86 teachers of mathematics, 44 males and 42 females. The ethnic populations of middle school mathematics teachers are: 41 white males (48%), 37 white females (43%), 3 black males (3%), and 5 black females (6%). One hundred of the 104 high school mathematics teachers and 83 of the 86 middle school mathematics teachers have tenure.

The minimum salary in 1989-90 for teachers with a BA was $23,500, with a maximum of $47,800 for those with a Ph.D. and 22 years of teaching experience. In ten years of teaching, Pittsburgh teachers reach the maximum on the PPS salary scale; however, $700 increments are provided for each year beyond 22 years. Pittsburgh teachers have the potential to reach the top of the salary scale within a ten-year period. Paid inservice days include six full noninstructional days (clerical days) and three inservice half-days (a total of 7.5 hours) at the high school level. In addition to the six full noninstructional days, middle school teachers receive two inservice half-days (a total of 4 hours). Attendance at inservices is mandatory. The teacher contract for 1989-90 covers 189 days, which includes instructional and inservice days.

In October, 1987, teachers approved a contract that went into effect in September, 1988, and will expire in September, 1992. Teachers are represented by the Pittsburgh Federation of Teachers (PFT), which is their bargaining agent; approximately 92 percent of all teachers are members of the union. The union president is Al Fondy. As negotiated by the union, the Teacher Interaction Period (TIP), a 90-minute block of time comprised of 45 minutes saved from the weekly schedule and 45 minutes of the teachers' own time that is used for weekly departmental meetings, continued in 1989-90.

## Professional Development Opportunities for Teachers

The Allegheny Conference Education Fund (ACEF) is sponsored by the Allegheny Conference on Community Development, a privately funded, non-profit organization whose purpose centers on improving the quality of life in Pittsburgh. Among the communal interests the Conference has identified are progress in education, economic growth, city planning, and neighborhood development. ACEF was established in 1978 as a link between the school district and city business, government, civic, and foundation leaders. The ACEF sponsors the Partnerships In Education Program, designed to link individual schools with corporations, higher education organizations, and associations around a common agenda of school improvement. ACEF is the funding agent of the Pittsburgh Mathematics Collaborative (PMC). Peter Love was chairman of the board of the Allegheny Conference and Nancy Bunt of ACEF is the liaison for the PMC. In the fall of 1989, the Conference added a new Committee on Education. The annual meeting of the ACEF was held on November 27, 1989, at the Carnegie Institute. Wesley von Schack, the chair of the Committee on Education, gave the after-dinner address, focusing on the positive things taking place in education in Pittsburgh. The Pittsburgh Mathematics Collaborative was lauded for its contribution to quality education in Pittsburgh and the first program to be showcased to this group.

## Special Opportunities for Students

Westinghouse Electric Corporation provided several $2,000 scholarships for top graduates from the Westinghouse High School of Science and Mathematics. A check in the amount of $175,000 was turned over to school officials: $100,000 of the fund was earmarked for scholarships, with the balance to be used for specialized training pay for teachers and to fund activities for science and mathematics students at the Homewood School. As many as 35 Westinghouse graduates will be eligible for the scholarship awards annually. The corporation plans to provide another $100,000 to the students' scholarship fund in the coming academic year. Scholarship donations were one outcome of the corporation's support of the Westinghouse High School's science and mathematics program. Begun in the fall of 1985 with 25 students, the program divides a student's instructional time equally between science and mathematics. Students who first signed up for the program as freshmen will be eligible for scholarships if they graduate with B averages during the 1989-90 school year. The aim of the partnership between Westinghouse Electric and the school is to improve the instruction that black students receive in mathematics and science and to encourage them to pursue careers in related fields. Students in the program work with Pittsburgh Zoo officials on research projects and are building a discovery room in the high school that will house hands-on science exhibits. Juniors will also spend a week on a Pennsylvania State University campus to hear lectures on physics and earth science, and sophomores will travel to the Friendship Hill Acid Mine Drainage site near Uniontown as a field experience. Freshmen will take part in a science program at the McKeever Environmental Education Center. Seniors may take on an individualized research project that could call for intervals on college campuses or summer jobs in the science industry.

On "Homework Hotline," broadcast live on television each Thursday from October, 1989 through June 14, 1990, four Pittsburgh high school seniors answered other students' homework questions. "Homework Hotline" was an hour-long program aimed at middle and high school students. Executive Director Merritt Holland anticipated numerous mathematics questions. The idea for "Homework Hotline" originated in Portland, Oregon, in 1989, and has spread to St. Louis, Chicago, Dayton, Boston, and Philadelphia. Moderator Jay Stone, a disc jockey from a local radio station, posed trivia questions and gave T-shirts as prizes for correct answers. The callers were screened to eliminate non-homework calls.

Dr. Leslie Salmon-Cox, coordinator of the Pittsburgh Mathematics Collaborative, helped Leslie Horne develop a program, Investing Now, to recruit talented minority youth to college campuses. Ms. Horne is associated with INROADS, which works with gifted highly successful African-American students to prepare them for college. The new program is staffed by the University of Pittsburgh and is also supported by funding from Carnegie-Mellon and Duquesne Universities. A new component of the program are the tutoring sessions held at Peabody High School. Dr. Salmon-Cox assisted Ms. Horne in planning the program and working out details, which included involving Pittsburgh teachers.

## Other Projects

School reform was identified as a national education issue in 1983 in the federal report, *A Nation at Risk*. Since that time, rising dropout rates, increases in teen pregnancies, and high unemployment among young adults has put even more pressure on educators to identify ways to effect change in the schools so that they better serve students. In October, 1989, 200 educators gathered at the University of Pittsburgh to discuss school reform, headed by a panel of eight persons, including Pittsburgh Public Schools Superintendent Richard C. Wallace. The forum was sponsored by the University of Pittsburgh's School of Education and allowed experts to share ideas about what reforms will be needed to lower the dropout rates and improve the academic performance of the nation's youth.

Edward A. Silver, senior scientist at the University of Pittsburgh's Learning Research and Development Center and professor of cognitive studies and mathematics education in the School of Education, is the director of QUASAR (Quantitative Understanding: Amplifying Student Achievement and Reasoning). QUASAR is a new initiative funded by the Ford Foundation to improve mathematics education for middle school students in disadvantaged communities across the country. An initial grant of $2,500,000 was announced in October, 1989; overall, $10,000,000 will be committed to the project. Beginning in 1990-91, selected schools will serve as initial development sites, collaborating with partners from the community to adapt or develop innovations in mathematics instruction. The focus will be on combining instruction in basic skills with higher-level reasoning and problem solving. A major portion of the project will center on developing new assessment tasks consistent with the new curriculum. The assessment will measure students' thinking and reasoning skills, their ability to solve complex problems, and their knowledge of a broad range of mathematics content. Dr. Leslie Salmon-Cox, the coordinator of the Pittsburgh Mathematics Collaborative, is the coordinator for Program Development for QUASAR, a 50 percent appointment.

## C. Development of the Collaborative

The Pittsburgh Mathematics Collaborative continued to be administrated during 1989-90 by Project Coordinator Dr. Leslie Salmon-Cox, although her active commitment, in terms of hours, was decreased from previous years. Barbara Bridge continued to serve as the collaborative liaison and assumed greater responsibility for administrative tasks related to the daily operation of the collaborative and the support of the standing committees. The Liaison Committee, under the guidance of Ms. Bridge, assumed increased responsibility for planning collaborative activities. The Executive Committee, or "First Tuesday Group," met as the schedule of its members permitted, but not on a monthly basis as in previous years. This committee served as a "concerned friend" in administrating the collaborative and provided an opportunity for people in critical positions in the collaborative to communicate with each other. The Steering Committee did not meet in 1989-90. Director Salmon-Cox did confer with the chair of the committee as needed. Rosemarie Kavanagh, a retired mathematics teacher, served as the on-site observer.

Project Coordinator Dr. Salmon-Cox continued in the effort to effect a smooth transition, removing herself from the daily operations of the collaborative in order to assume the role of an advisor to those within the existing structures, the school district, and the Allegheny Conference. During 1989-90, Dr. Salmon-Cox influenced the setting of priorities for the collaborative and helped others in their planning. She continued to maintain control over the budget. The overall strategy in the development of the Pittsburgh Mathematics Collaborative, as described by Dr. Salmon-Cox, has been "small incrementalism." The objective has been to shape the culture of mathematics education in Pittsburgh by strengthening or creating working committees, forming links between those within mathematics education and other sectors, and enhancing the leadership abilities of individual mathematics teachers.

In implementing this strategy, Dr. Salmon-Cox has become very visible to the mathematics teachers and is seen as a strong advocate for mathematics education. This visibility was reduced some in 1989-90 when her collaborative responsibility mainly involved meeting with the First Tuesday Group (the collaborative's Executive Committee), Dr. Briars, and Ms. Bridge. She did help form new links and strengthen old ones between the collaborative and others in the area. An example was her meeting in October with Dr.

Briars and the chairman of the Mathematics Department at Duquesne University to explore an interest in working with high school and middle school teachers in the area of problem solving.

Another example was Dr. Salmon-Cox's meetings with and presentations to the Allegheny Conference Board where she was able to publicize the collaborative. Her 12-minute presentation, and then responses to questions, was made before the Executive Committee of the Allegheny Conference on Community Development as part of a report to the newly formed Education Committee. In attendance were the superintendent of the Pittsburgh Public Schools, the president of the Pittsburgh AFT, and the provost of the University of Pittsburgh. At an annual dinner meeting of the Allegheny Conference held November 6, 1989, the mathematics collaborative was cited as one of the good things happening in education in Pittsburgh.

Collaborative Liaison Barbara Bridge assumed greater responsibility for the day-to-day operations of the collaborative such as attending the high school Instructional Team Leaders meetings and assuring refreshments were provided. She and the Liaison Committee met several times during the year. Ms. Bridge's other work with the Allegheny Conference, through Partnerships In Education and Pittsburgh Promise, although not directly linked with the collaborative, provides a direct connection with those in business. In the course of this collaboration, she worked with corporations to develop different partnership relationships that had an impact on the mathematics program, primarily through students. In addition to working through the Liaison Committee, Ms. Bridge edits the collaborative newsletter when it is issued and discusses collaborative activities with the others who have administrative responsibility for the collaborative.

Dr. Diane Briars, district director of mathematics, has been crucial in the development of the collaborative as it became established in the district. She and the mathematics supervisors often help in planning for collaborative activities. In 1989-90, committees of teachers instigated by or energized through the collaborative were coordinated by Dr. Briars or one of the supervisors. These committees included the Secondary Instructional Teacher Leaders Group, the Middle School Instructional Teacher Leaders Group, and the Computer Training Group. In addition, teachers served on district mathematics curriculum committees that recommended and developed materials for specific courses.

## Executive Committee

The Executive Committee, the First Tuesday Group, met on several first Tuesdays during the school year, but not every month. Those who attended the meetings included Dr. Salmon-Cox, Ms. Bridge, Dr. Briars, Nancy Bunt of the Allegheny Conference on Community Development, and Ms. Jeanne Berdik of the Partnerships In Education. One member described the group as "concerned friends" of the collaborative. Some functions of the First Tuesday Group are to advise the project coordinator and to review the collaborative's program and its link to the school district. Since members of the group all have busy schedules, setting a fixed time for meetings has served to provide the project coordinator timely feedback and a forum for sharing ideas. Other members valued the experience because of the networking they were able to do with the others. This group was initiated by the project coordinator to meet her needs. As her active involvement in the collaborative has declined, so has the regularity of group meetings.

## Secondary Instructional Teacher Leaders (ITL) Group

The secondary Instructional Teacher Leaders (ITL) Group is comprised of the mathematics instructional teacher leaders from each of the 12 high schools. This group meets monthly during the school year, generally on a Monday afternoon for two to three hours, beginning some time after 3:00 p.m. Meetings are held at the district mathematics office on Boggs Avenue. It is expected that each of the teacher leaders will attend each meeting. The meeting is chaired by the director of mathematics. In addition, the project coordinator and/or collaborative liaison attend the meetings along with the two district secondary mathematics supervisors. While the secondary ITLs act on collaborative-related business and serve as a communication link between the collaborative and teachers, most of the group's time is spent planning and devising district policy regarding all aspects of secondary mathematics education. The ITL group has enhanced the department chair's position and gives members an opportunity to confer with each other.

The meetings generally begin with announcements of future programs, inservices, or other information relevant to the district mathematics program. This is followed by an update on the collaborative by one of its administrators. This part of the meeting is used to inform the ITLs of future collaborative activities, recent activities of the UMC network, the UMC annual meeting, and information on the UMC electronic network, Bread Board. The remaining time in meetings is spent on topics generally requiring some discussion or action by the group.

At the September meeting, the group decided to have joint meetings with the middle school ITLs and began planning district inservices related to the Second International Mathematics Study (SIMS) report. In November, planning for the inservices continued. In addition, a professor from Duquesne University talked about collaboration between the teachers and the Duquesne Mathematics Department. In February, the group decided that the next series of cluster inservices should extend what was begun earlier and focus on the SIMS report. Other topics discussed included the EDC Outreach proposal; what should be emphasized in algebra and geometry courses; placement tests; the correct placement of students in mathematics classes; the planning of the basic skills assessment, and its cut-off score; and the lowering of standards due to pressure from administrators who respond negatively to teachers issuing a high percentage of failing grades. At the March meeting, the team leaders reported on each department's intervention plans which the district had asked them to develop. In addition, the ITLs were asked to get feedback from teachers on the Problem-Solving Test administered in the 9th-grade's new problem-solving course, which replaces general mathematics. Updates on the intervention plans were presented at the April 30 meeting along with reports on supply and equipment needs and the assignment of student teachers to mentor teachers. No meeting was held in May. The Frank Demana presentation served as the June meeting.

Two joint meetings were held during the school year between the middle school ITLs and the secondary ITLs. On October 2, 1989, the two groups met for the first time. The group as a whole discussed both scheduling issues and communication problems. The discussion on scheduling centered on incoming 9th-graders and how best to meet their needs: specific issues included the piloting of an algebra-readiness survey, placement criteria, interfacing with pupil services, and assuring that high school teachers provide data to middle school teachers on readiness criteria for 9th-grade mathematics. A seven-member committee was formed to continue the work on scheduling issues. Communication between the two groups was the second major concern of the meeting. Major points raised focused on the importance of all teachers having knowledge of the K-12 curriculums (both the intended and the real); the need for high school teachers to know middle school policies; the importance to both high school and middle school teachers of visiting the classes of those from the other level; and the need to have common time for cluster inservices. A list of all the ITLs and their phone numbers, from both groups, was distributed at the meeting.

The first meeting of the two groups generated a good discussion, but did not provide an opportunity for members to get to know each other. The second meeting, December 18, was more informal. The two groups met at 4:00 p.m. at the Learning Research and Development Center to enjoy pizza and beer. The collaborative coordinator observed that teachers seemed to enjoy being with their counterparts from another level of instruction.

## Collaborative Liaison Committee

The Collaborative Liaison Committee includes one representative from each of the 12 high schools. The group is coordinated by Barbara Bridge, the collaborative liaison. The group met monthly during 1989-90. The major responsibility of the Liaison Committee was to plan the special gatherings of collaborative teachers. Adding to responsibilities of the previous year, the group developed a questionnaire to determine the extent to which teachers were using resources such as grants, summer internships, and persons from the business world as speakers. Teachers were also asked questions about their interest in certain activities. The questionnaire was administered in June, 1989. The data were tallied and then used during a discussion with the ITLs. During the year, the Liaison Committee planned the fall picnic, the collaborative receptions, and for Math Awareness Week, the Problem A Day Mathematics Contest and Speakers Bureau.

## Steering Committee

The Steering Committee, which meets annually to discuss the collaborative's direction and activities, is comprised of 27 members, including representatives from the business and university communities, the school district, and several local funding organizations. The Steering Committee is chaired by Robert Wilburn, president of the board of the Carnegie Institute. The committee did not meet during the school year. Dr. Salmon-Cox and Mr. Wilburn had a series of conversations to plan for the presentation to the Allegheny Conference Education Group.

## D. Project Activities

The Pittsburgh Mathematics Collaborative sponsored a variety of activities for Pittsburgh's middle school and secondary mathematics teachers during the 1989-90 school year. A primary focus of the collaborative's activities was to encourage dialogue with others around common issues in mathematics--both in educational settings and in the work place. The collaborative was able to extend its resources and services to middle school teachers as a result of a grant for the Middle School Mathematics Project awarded by the National Science Foundation.

### Kick-Off Picnic

The Pittsburgh Mathematics Collaborative Liaison Committee sponsored a Kick-Off Picnic for middle and high school mathematics teachers and their families on Sunday, September 24, 1989, from 1-6 p.m. at Cayuga Grove Settlers Cabin Park in Robinson Township. Everyone brought their own food and the collaborative provided beverages. The picnic afforded teachers the opportunity to renew old acquaintances and meet other teachers who shared their professional interests and concerns. Advance reservations were made through the ITLs.

Approximately 40 people attended the picnic. The collaborative coordinator felt that some people did not attend because they perceived Settlers Cabin Park to be farther away than it actually was. Next year, however, the collaborative will try to hold the picnic at a city park. The on-site observer reported that it was a beautiful day and that those who attended enjoyed themselves. In a letter to the collaborative coordinator, a teacher wrote, "Thanks again for organizing the picnic. Our two kids did not want to leave the playground. They really enjoyed it . . . keep up the good work."

## Presentations and Receptions

### Michael Serra Reception

The Pittsburgh Mathematics Collaborative and the Pittsburgh Public Schools sponsored a presentation by Michael Serra, author of *Discovering Geometry* and a member of the San Francisco Urban Mathematics Collaborative. Serra's textbook was piloted during the 1988-89 school year at Langley High School and was pilot-tested in several other high schools during 1989-90.

The collaborative sponsored a reception following the presentation, from 2:45-3:30 p.m. Both events were held at the Sheraton Hotel-Station Square. All secondary mathematics teachers were required to participate, since the event took place during the regularly scheduled Teacher Interaction Period (TIP). Serra's presentation marked the first time the mathematics department received permission from the district to use TIP time for a district-wide gathering.

### Frank Demana Reception

On June 6, 1990, from 3 to 5 p.m., the Pittsburgh Mathematics Collaborative hosted an end-of-year celebration and wine and cheese reception for PPS secondary mathematics teachers at the Holiday Inn. Author and Ohio State University Mathematics Professor Frank Demana was the guest speaker. Dr. Demana's presentation, "NCTM Standards, Graphing Calculators, and High School Mathematics," focused on how new developments in technology are changing the roles of mathematics teachers, students, and traditional subject matter for grades 9-12. Dr. Demana, using two overhead projectors, demonstrated the Texas Instruments TI-81 graphics calculator. Dr. Demana's textbook, *Precalculus Mathematics: A Graphing Approach*, was pilot-tested at Schenley High School during 1988-89 and at Brashear, Oliver, Allderdice, and again at Schenley High Schools in 1989-90. The book will be used in 1990-91 in all PPS elementary functions courses. The school district will provide a TI-81 calculator for all students taking the functions course.

The reception, which was planned by the Collaborative Liaison Committee, was designed to foster professional development and promote collegiality. Approximately 45 teachers attended the event. The on-site observer reported that the teachers present seemed to be impressed by the presentation.

## Inservice Programs

Four years ago, as a direct result of the joint efforts of the PPS director of mathematics and the coordinator of the Pittsburgh Mathematics Collaborative, the district instituted cluster inservice days. Twice a year, the mathematics teachers from several high schools that are geographically proximate meet for a half-day of inservice education. Each of the three clusters has the same two-hour inservice on a different day. During the 1989-90 school year, the cluster inservices were held in October, 1989, and February/March, 1990. In addition, the district sponsored a third half-day of inservice which was attended by all PPS high school mathematics teachers. The district-wide inservice was held on January 31, 1990.

The inservice programs are conducted by the district's Department of Mathematics, with the collaborative playing a tangential role. The inservices are planned with the input of the secondary ITLs and often feature presentations by teachers who have received collaborative support to attend conferences and meetings. The collaborative provides refreshments.

### October Cluster Inservices

The Division of Mathematics of the Pittsburgh Public Schools sponsored mandatory mathematics cluster inservice workshops in October for all secondary mathematics teachers. The three fall cluster inservices were held on October 17, October 24, and October 31, from 12 to 2:15 p.m. The fall cluster inservice program began with a one-hour general meeting in which Dr. Briars discussed the Mathematics Assessment Program (MAP) Performance Assessments for Algebra 1, Algebra 2, and Geometry. This was followed by a presentation by Mary Lynn Raith of the Division of Mathematics, "New

Developments in the Middle School Mathematics Curriculum," in which she reviewed the areas of mathematics being taught in the middle schools.

For the last half of the inservice, the teachers had the option of attending one of three sessions: Problem Solving I, presented by Mathematics Supervisor Diane Briars; the IBM *Mathematics Exploration Toolkit* presented by Richard Wertheimer of the Division of Mathematics; and Using the Graphics Calculator, presented by Oliver High School teachers Marshall Cherner and Lynn Siegwarth. All computer science teachers were directed to attend a session on Computers in Education.

## January District-Wide Inservice

An inservice workshop for all secondary mathematics teachers in the Pittsburgh Public Schools was held from 12:30 to 3 p.m. on January 31, 1990, at Langley High School. The purpose of the workshop was to provide teachers with an opportunity to interact and to hear presentations relating to mathematics.

The workshop began at 12:15 p.m. with a presentation by Richard Wertheimer of the PPS Division of Mathematics on the Second International Mathematics Study (SIMS). Mr. Wertheimer discussed the results of the study, highlighting the comparison between Japanese and American schools regarding the proficiency levels in mathematics achieved by students.

At 1:30 p.m., following the general session, the teachers divided into small groups to discuss the SIMS report and its implications. The general session reconvened at 2:30 p.m. to report back on the interchanges that had occurred in the small groups. The discussion that followed was very lively, with teachers raising such issues as discipline in Japanese schools, absenteeism, motivating parents, class size, repetition of curriculum in grade schools, whether Japanese teachers are pressured to lower their standards to decrease the failure rate, and the need for more preparation time. Diane Briars concluded the meeting by challenging teachers to come forward with innovative suggestions for reversing those conditions discussed that were factors in their own schools.

## February/March Cluster Inservices

The school district sponsored cluster half-day inservices at three high schools in mid-February and early March. The ITLs had decided to make the inservices an extension of the January district-wide inservice at which the SIMS report had been presented. The topic of the inservices was "Increasing Student Achievement: Next Steps."

The first cluster inservice was held February 15, 1990, at Letsche Education Center for all of the mathematics teachers from Carrick, South, Brashear, Letsche, and Schenley High Schools. Similar workshops were held February 22 at Oliver for teachers from Perry, Langley, Oliver, and McNaugher High Schools, and March 1 [2] at Westinghouse for high school teachers from Westinghouse, CAPA, Peabody, and Allderdice High Schools. Dr. Diane Briars and Richard Wertheimer, both of the PPS Division of Mathematics, opened the inservice with a presentation, "Programs that Have Increased Student Achievement." One program they discussed constituted a strategy employed in West Germany to reduce the dropout rate that involved keeping high risk students with the same teacher from 3rd-grade to 10th-grade. They presented details on a program in Los Angeles that recruited students in the middle schools and required a special commitment from both parents and students; on a program at Carrick High School through which high risk students are identified and grouped together; and on a program at Westinghouse High School in which high school students tutor elementary students and also receive help in Algebra II. At 1:15 p.m., following a brief break, the teachers broke into three discussion groups. The groups were given two topics to work on; they were asked for (1) their reactions to the programs that have increased student achievement, and (2) their ideas regarding what can be done to change the mathematics achievement of PPS students. The discussion groups were facilitated by Diane Briars, Richard Wertheimer, and a teacher from the cluster. At 2:00 p.m., the teachers reconvened as a group to report on the small group discussions.

One group reported that while they were unhappy with their students' lack of motivation and achievement, they felt powerless to make a difference. They felt that the greatest impediments were large class size and pressure upon teachers to lower their standards because administrators frowned upon teachers whose student grades indicated a lack of achievement. The reporter from the group said that the teachers have a dim view of the future. The second group reported on their concern that students do not have realistic expectations regarding the training that they must have to secure the job of their choice. The group also stressed the need to enlist parental support and involvement. The final group suggested that a pilot program similar to the one in West Germany be tried at CAPA High School. The group supported the suggestion of having an adult volunteer in the classroom. Their final recommendation was for a structured study skills course for 9th-grade students.

At the end of the session, Diane Briars asked each school to develop a proposal to address solutions to some of these problems. She told the teachers that not all changes will require the expenditure of money and that the proposals will be reviewed at ITL meetings to identify the resources necessary for implementation. The proposals were due March 26, 1990.

## Mathematics Departments Intervention Plans

As an outcome of the January district-wide inservice on the SIMS study and the follow-up February/March cluster inservices, which focused on the next steps needed to increase student achievements, each mathematics department was directed to develop an action plan for resolving some of the problems that inhibit student achievement in mathematics. The action plans were initially presented at the March 26 meeting of the secondary mathematics ITLs and updated at the April 30 meeting. The plans for each high school mathematics department are summarized below.

Peabody High School will create a mathematics department laboratory staffed by teachers during their duty periods. The lab will serve as both a reward for better students and remediation for the slower students. An effort will also be made to modify one teacher's schedule to enable that teacher to report to school one period later in the day so that he/she can remain after school to provide individual tutoring. Langley High School will focus on improving SAT scores. Next year, each teacher of Algebra I, Geometry, or Algebra II will begin each class every day with questions from old SAT booklets. Perry High School is considering initiating some tutoring programs. The focus of the action plan at Allderdice High School is on the appropriate placement of students in mathematics classes. The mathematics department plans to invite the guidance counselors to meet with them during TIP time to discuss student placement guidelines for mathematics classes. In addition, each mathematics teacher will talk with his or her students about the mathematics needed for college as well as for job opportunities. South High School is also addressing the problem of placement. The teachers plan to review the students' choices of mathematics classes, discuss their choices with them, make recommendations, and then share the information with the counselors. They also hope to introduce a half-year SAT preparation course. Schenley High School will focus its efforts on getting more students to take algebra.

Westinghouse High School proposes to schedule an extra period a week to bring together algebra and geometry students for enrichment purposes as well as to show a relationship between the two disciplines. The students will spend the one period a week in the mathematics laboratory doing peer tutoring. The department also plans to continue its tutoring program, through which high school students tutor grade school students. Oliver High School plans to initiate a tutoring program. Student tutors, to be paid $4 an hour for 25 hours, will tutor from 2:10 to 3:10 p.m. during the spring semester. Simultaneously, the department is making an effort to standardize student notebooks and develop students' organizational and note-taking skills, as well as to incorporate more pop quizzes. The department's action plans also include developing a videotape library containing enrichment materials. CAPA High School plans to monitor student study groups and use students in advanced mathematics classes to tutor other students. Perry High School also plans to develop a tutoring program.

Letsche High School's action plan addresses a perceived problem of student performance on major tests and the students' need to feel successful in order to improve their self-images. Part of the department's objective is to decrease the stress factor in testing. The department has decided that since its students do poorly on major tests, but well on short quizzes, the use of fewer major tests and more short quizzes will result in more positive feedback on the part of the students. In addition, the teachers plan to repeat questions from previous lessons.

The Mathematics Department at Brashear High School was concerned about the large number of students entering the 9th-grade without basic skills. To address this problem, the testing and review of basic skills will become an important feature of all 9th-grade curricula. The department will also develop lists of minimum basic skills that students should have upon completing each class.

Carrick High School plans to modify its current scheduling procedures so that four problem-solving classes are offered at the same time. This will enable the department to place students with poor attendance in the same classes so that they can get individualized instruction. In addition, the department plans to group 40 moderate-risk students together and give them special attention in laboratories and study halls.

The project coordinator reported, "The fact that each school has now identified its major problem and feels that its teachers are being heard is partly the result of the collaborative, partly Diane's efforts, the NCTM *Standards*, and teachers feeling more professional. The mathematics departments are the only departments in Pittsburgh's public schools that are enjoying such recognition and [are] acting accordingly."

### UMC Outreach Action Grant

In response to a request for proposals to fund grants of up to $10,000 by the UMC Outreach Project, the Pittsburgh Mathematics Collaborative developed a proposal to offer a group of teachers concrete techniques for enhancing their interaction skills. The announcement of the grant went to all secondary ITLs. Each chair then discussed the grant proposal with his or her department during TIP time. In December, 1989, the ITLs met with the staff of the PPS Division of Mathematics and Project Coordinator Leslie Salmon-Cox to discuss ideas for a proposal. A key focus of the discussion was Rudy Berty's and Jaclyn Synder's account of their experience at the EDC Teacher Leadership Workshop. Out of these discussions the focus of the proposal evolved--a plan to enhance teacher networking through staff development.

The proposal was designed to develop the interpersonal skills of a core group of Pittsburgh's secondary mathematics teachers. Associated with the development of the skills component is the development and implementation of action plans for each mathematics department. The proposal outlines plans for a weekend retreat/conference in November, 1990, for 40 to 60 teachers to help them develop such interpersonal skills as self-assertion, active listening, and sequencing. During the weekend, small groups of teachers from the same school will also design school-based action plans. The action plans will be refined and implemented during TIP periods from November through

February/March. At the spring cluster inservices, teachers will discuss and compare their efforts and revise their plans based on what they learn from others. The collaborative plans to hire an outside consultant to facilitate the effort. The management of the overall project will be shared by the authors of the proposal, ITLs Rudy Berty and Jaclyn Snyder.

In March, 1990, Jaclyn Snyder and Rudy Berty were notified that the proposal received full funding. In a letter congratulating the two department chairs, Leslie Salmon-Cox and Diane Briars wrote, "The existence of this grant signifies several important things. First, it will provide funding for a substantial teacher enhancement project. Further, under your leadership the project is a significant contribution to teacher-initiated professional development in Pittsburgh. Second, the activity shows the growing teacher ownership of the collaborative project as well as the institutionalization of the Collaborative's aims and objectives . . . ."

### Mathematics Awareness Week

The Pittsburgh Mathematics Collaborative worked hard to promote Mathematics Awareness Week, April 23-27. Special events included a "Problem of the Day" mathematics contest for students. The collaborative also organized a Speakers Bureau of professionals in mathematics-related fields prepared to speak with students about mathematics applications in the work place. The response from teachers was overwhelming; the collaborative received 80 requests for speakers. Collaborative Liaison Barbara Bridge was able to arrange for speakers to visit 35 classrooms during Mathematics Awareness Week and sent a letter to all the teachers asking whether she should continue to try to fill the requests during the remainder of the school year or whether she should schedule the speakers for the coming fall or during Mathematics Awareness Week 1991.

PMC Coordinator Salmon-Cox and PPS Mathematics Director Briars also met with local newspapers to request editorials on the importance of mathematics education; they also submitted an article to the *Post Gazette* that was published in June. In addition, they prepared public service announcements encouraging students to expand their career options by studying mathematics. These announcements had not been aired by the end of the 1989-90 school year. While the announcements were not completed in time to be used for Mathematics Awareness Week, it is hoped that radio stations will broadcast collaborative/district items in the future.

## Curriculum Development

In addition to the secondary Instructional Teacher Leaders group and the middle school Instructional Teacher Leaders group, a variety of teacher committees or groups met during 1989-90 to discuss the mathematics curriculum, including the Geometry Pilot Program, the Computer Group, the Problem Solving I and II Committee, and the TAS Committee, which is working to revise the current Trigonometry, Analysis, and Statistics course. Some of these groups have been mandated by the superintendent to make recommendations for revising the secondary curriculum. While these committees are under the jurisdiction of the school district, the collaborative offers support as needed.

### Geometry Pilot Program

During the 1988-89 school year, five collaborative teachers conducted a pilot test of a new approach to geometry at Langley High School that emphasized discovery learning, hands-on experience, and the student construction of knowledge. The geometry curriculum was reorganized so that the first semester focused on reinforcing Algebra I and developing students' knowledge of geometric concepts and relationships; work on geometric proofs was delayed until the very end of the course. The teachers used the textbook *Discovering Geometry*, by Michael Serra, a teacher in the San Francisco collaborative.

According to Coordinator Salmon-Cox, "The results of the pilot have been exciting. Compared to a normal dropout rate of one-third to one-half, this year there have been few dropouts." The participating teachers reported that the number of students showing deep understanding of the material was much higher than in the past, and that students come to class eager to get to work.

During the 1989-90 school year, the course was offered at Langley High School and was also extended to Oliver, Perry, and CAPA. Teachers who have used the book report that students seem to have improved their attitude toward geometry from previous years and are more willing to attack problems. No formal evaluations of the course were available at the time of this report, since the data were in the process of being analyzed.

## The Computer Group

In August, 1986, the Pittsburgh Mathematics Collaborative received a challenge grant from the Pennsylvania Ben Franklin Partnership Program to train a select group of ten secondary mathematics teachers to be computer literate. The teachers began their training during the 1986-87 school year; they met over the summer and monthly during 1987-88 to share their reactions to the software they had reviewed, to design instructional modules for the training of additional teachers, and to create guidelines for the use of computers in mathematics classrooms. During the summer of 1988, the members wrote more than 80 lessons to share with other teachers and, during 1988-89, the group developed and taught an increment credit course on using the computer to teach mathematics. Approximately 30 teachers participated in the six-week course, which was held in February and March, 1989. When the funding expired at the end of the 1988-89 school year, because teachers had refused payment for time spent, funds were left over. These funds were used to purchase modems and software to enable high school mathematics departmental offices to communicate with each other, as well as with the Division of Mathematics office at Boggs, so teachers would be able to access the laser printer.

## Middle School Mathematics Project

Dr. Salmon-Cox and Dr. Briars are coprincipal investigators of a major grant from the National Science Foundation to establish a model program for Pittsburgh middle school mathematics teachers. The $438,000 grant was awarded to the Learning Research and Development Center for a three-year period beginning in August, 1988, and is being matched by a contribution of $386,000 from the school district. The three-year program includes several components: teacher inservice education through workshops and time spent at the recently established Middle School Teacher Center; follow-up activities in the teachers' home schools; linkages to business and industry; invited speakers; opportunities for teachers to interact with other mathematics professionals, including secondary mathematics teachers; and leadership development for teacher participants. A key aspect of the program is that some of the inservice sessions are mandatory for the 86 middle school teachers in Pittsburgh. In addition, a teacher has been put on "special assignment" to work closely with middle school teachers in their classrooms, to follow up on their experiences at the Teacher Center, and to model new instructional techniques in the use of the new Middle School Mathematics Project materials. It is anticipated that the program will result in the formation of a cohort of teachers more knowledgeable about mathematics, issues of instruction, adolescent learning and related research--in short, mathematics professionals for middle schools.

In August, 1989, as in August, 1988, a week-long inservice program was held for middle school mathematics teachers. The sessions, which ran from 8:30 a.m. to 3:30 p.m. for five days, were held at Greenway Middle School Teacher Center. The focus of the inservice was on ratio, proportion, percent, and fractions along with two underlying strands of problem solving and basic mathematics. Of the 86 middle school teachers who were invited to participate, 60 attended, which was considered to be a good representation, especially because the teachers were still on summer vacation. The teachers who attended were compensated by the district at the regular workshop rate of $15.21 per hour. The teachers seemed to be enthusiastic during the inservice week and their comments after the workshop were extremely favorable. Originally the teachers had expressed some unhappiness about the addition of a lunch hour which extended the day, but once they experienced the break in the routine and the opportunity for social exchange, they saw it as a favorable change.

In July, 1989, a documenter was hired to record the development of the project and the impact it was having on classroom instruction. Several meetings were held during the 1989-90 school year to plan various aspects of the Middle School Mathematics Project, including inservice and other experiences for middle school teachers. On October 11, for example, the NSF Middle School Planning Group met with Dr. Salmon-Cox to discuss the types of interviews that would be conducted with middle school teachers to document the changes being made in classrooms as a result of the project.

In October, 1989, the district scheduled the first cluster inservice for middle school teachers. The cluster model was based on the successful inservice experience of the secondary mathematics teachers. (Mathematics teachers participate in inservice workshops with teachers from other schools in "clusters" that are based on the schools' geographic locations.) The focus of the October inservice, which was held on October 13 for teachers from schools in Cluster I, was to compare the Monitoring Achievement in Pittsburgh (MAP) mathematics objectives with the California Achievement Test (CAT). Teachers had expressed concern that if they concentrated their efforts on the mathematics objectives, the CAT scores would suffer--an issue compounded by the fact that the CAT scores are published in the newspapers. Dr. Briars allayed teachers' concerns by assuring them that once the district mathematics objectives were achieved, CAT scores would rise.

As part of the Middle School Mathematics Project, PPS middle school teachers participated in half-day visits to three area businesses--Equibank, Equitable Gas, and Pittsburgh National Bank. The site visits provided the teachers with an opportunity to observe first hand the practical applications and minimum mathematics training required by these businesses. During the 6 p.m. news on the day of the Equibank site visit, local television station KDKA reported on the teachers' visit. The news segment also included a statement by Diane Briars. These visits were reported in the weekly, *Pittsburgh Business Times*. A manager from one of the businesses was quoted, "[During our presentation], we focus on math concepts and applications and how these skills are used in the work place. Teachers want to know what math levels are needed for different jobs."

## Math-Intensive Partnership Program

In order to enhance the rapport between representatives of business and industry and the secondary mathematics teachers in the city schools, the collaborative, at the request of teachers, has encouraged the formation of individually defined math-intensive partnerships. The first such partnership, initiated during the 1987-88 school year, was established between PPG Industries and Langley High School, which already enjoyed a working relationship resulting from the Partnerships In Education (PIE) program. The project centered on a tutoring program for mathematics students. During the 1989-90 school year, Langley and PPG Industries initiated a new project, "Future Jobs," that focused on the mathematics needs of non-college bound students. A group of about 15 PPG employees, not all on each day, spent two hours on Wednesday afternoons during the school year tutoring students in algebra, geometry, calculus, and trigonometry.

### Professional Development Grants

The Allegheny Conference Fund awarded Professional Development Grants to collaborative teachers to sponsor their attendance at professional meetings, workshops, and seminars; to consult with fellow teachers and colleagues in the private sector; and to investigate areas that can enhance their professional development. Individual grants may total up to $300. The program had originally been designed for secondary mathematics teachers, but was expanded to include middle school mathematics teachers.

Teachers are periodically reminded of the availability of Professional Development Grants through ITL meetings and Collaborative Liaison Committee meetings. In addition, in November, Collaborative Liaison Barbara Bridge sent a flyer to all middle school and secondary mathematics teachers announcing the grant program. To receive a grant, interested teachers apply to the collaborative 60 days before the event for which funding is requested. The application asks teachers to provide an explanation of how the event is related to their professional development and/or how it will influence mathematics instruction. In addition, they must make arrangements with the Director of Mathematics to share the information they gain with their fellow teachers. The decision as to which grant requests will be funded is made by the "First Tuesday" group.

New guidelines were established for the 1989-90 school year which limited a teacher to applying for only one grant per school year. Special consideration for awarding a second grant would be given, however, to teachers who were speakers at professional associations or meetings. At the November 1989 meeting of the First Tuesday group, the point was made that a $300 grant would cover only part of a teacher's expenses, whereas all other professionals are usually adequately compensated for conference expenses. Plans were made to discuss with the superintendent of the school district and the president of the teacher's union ways for incorporating grant funds into the school district budget or union contract. In the interim, the Allegheny Conference will continue to fund the grants.

Thirty-four grants have been awarded since 1987. Between February, 1989, and August, 1990, twelve Professional Development Grants (PDG's), funded by the Allegheny Conference Educational Fund, were awarded to mathematics teachers. Grants were used for attendance at professional conferences and meetings, or for university coursework. Two grants were awarded to teachers to attend the NCTM Annual Meeting in Salt Lake City; three to teachers to attend College Board Advance Placement Institutes; three teachers to attend the PCTM meeting in Harrisburg; two to teachers to attend a University of Chicago School Mathematics Project meeting in Chicago; one to a teacher to attend the National Middle School convention in Toronto, and one to a teacher to attend the TI-81 Graphing Calculator Workshop at Ohio State University.

## National and Regional Workshops and Conferences

### Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

Two secondary mathematics teachers, Jackie Snyder from Langley High School and Rudy Berty from Washington High School, were selected by Dr. Salmon-Cox and Dr. Briars to represent the Pittsburgh Mathematics Collaborative at the workshop. They based the selection on who they felt would get the most from the experience and bring ideas back to other teachers. EDC had agreed to sponsor two teachers from each collaborative, paying for room, board, registration, and transportation.

The two teachers appeared to find the workshop a valuable experience. In their report to the ITLs on the workshop, the teachers said they believed that the Pittsburgh schools are really in the forefront of innovative activities and have solved or are in the process of solving problems that other districts are just beginning to recognize and have not yet begun to solve. As a result of their participation in the Teacher Leadership Workshop, EDC invited Jackie Snyder to participate in a teacher panel discussing equity issues at the October 1989 UMC Annual Meeting in Los Angeles.

### Making Mathematics Work for Minorities Regional Workshops and National Convocation

The Making Mathematics Work for Minorities project of the Mathematical Sciences Education Board (MSEB) is a decade-long program designed to reverse long-standing patterns of underachievement and underrepresentation of minorities in mathematics. During 1989-90, the MSEB sponsored six regional conferences during which concerned Americans identified educational programs that work for minorities, delineated factors that influence minority achievement, and reached a consensus on the directions for change. In May, 1990, a national convocation was held in Washington, D. C., as a culmination of the regional workshops. The national meeting built on the regional workshops, producing a national action plan and launching Project AIM, the Alliance to Improve Mathematics for Minorities. The convocation was an invitational meeting for representatives from the six regional conferences. The meeting addressed the concerns of educators, legislators, parents, business, industry, funding agencies, students, and national, state, and community organizations.

Four representatives from Pittsburgh participated in the regional conference that was held in Princeton, New Jersey, November 17-20, 1989; the collaborative coordinator, Dr. Briars, Rudy Berty (an ITL), and John Spavero (a science ITL). Dr. Leslie Salmon-Cox, PMC coordinator, conducted the summary and conclusion sections for the conference. Dr. Salmon-Cox and Dr. Briars also participated in the National Convocation that was held in Washington, D. C., on May 3-4, 1990.

G-30

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Pittsburgh collaborative provided professional development grants of $300 each to two secondary mathematics teachers to attend the 68th Annual Meeting of NCTM in Salt Lake City, Utah, April 18-21, 1990. In addition to these teachers, District Mathematics Supervisor Diane Briars attended the conference, as well as a few teachers who attended the meeting through other funding, or on their own.

The theme of the NCTM conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened for the purpose of achieving new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

Joanne Meldon, a mathematics teacher at Allderdice High School and an active member of the Pittsburgh collaborative, presented a session at the conference, "Estimation and Mental Mathematics Activities for the Reluctant Learner." In her session, Ms. Meldon discussed creative ways to work with estimation and mental mathematics in the high school classroom, using games. She also addressed issues such as incorporating into classroom practice estimation, mental mathematics, problem solving, and pattern recognition, as well as techniques for making mathematics relevant to students.

## E. Observations

### Project Management

The evolution of the Pittsburgh Mathematics Collaborative has been different from that of the other ten collaboratives. In Pittsburgh, the collaborative developed primarily through focusing internally on the modification of existing structures rather than on turning outwardly to create a new managing framework. Certain conditions have existed in Pittsburgh that have made this a viable strategy. The size of the district is not overwhelming; the project coordinator, who has provided visionary leadership, has had very capable people to work with in the director of mathematics and the collaborative liaison; the district administration has been cooperative and innovative; and the district mathematics office has been competently staffed by five mathematics supervisors working with the director of mathematics. Some of these conditions exist at other collaborative sites, but at none of them do all of these factors work concurrently as they do at Pittsburgh.

In reflecting on "small incrementalism" as a strategy for collaborative development, certain features of the approach help clarify the strategy. Under the conditions that prevailed, the strategy has been successful in achieving at least some of its stated goals. The main goal that has been achieved is an energized secondary mathematics faculty with a number of teachers deeply involved in mathematics curricular and policy issues.

One feature is that the PMC coordinator's original vision of the collaborative being diffused into the system has remained constant. "[H]er. . . concern from the beginning was empowering these teachers with building a sense of community among them that did not [previously] exist," reported the director of the Allegheny Conference on Community Development. The first group Dr. Salmon-Cox approached after the grant was made to the Allegheny Conference was the group of secondary mathematics department heads who met once a semester. She talked briefly about the potential of a collaborative. One possibility was that teachers would be actively involved in making decisions. One department head at the meeting described the group as having no decision-making power at that time, " . . . looking back five years ago, we had zero input. We had nothing." After hearing Dr. Salmon-Cox explain the potential of the collaborative, the department head recalls her initial reactions, "Boy, doesn't this sound like something? Wouldn't it be exciting if we could actually make a decision." The observation regarding zero-input is in stark contrast to the current feeling of the ITLs, whose members feel that they now play a major role in making decisions for the district's mathematics program. Important to the development of the collaborative and its management was the evolution of the ITLs into a group that assumed greater decision-making responsibility.

Maintaining a focused vision has some drawbacks. One is that the narrow focus has retarded any effort to forge new structures for expanding the interchange between teachers and those in the community at large--business, industry, and higher education. (In Cleveland, for example, an Advocacy Committee has evolved as the result of the collaborative's capacity to reach beyond the existing system.) A second drawback is that maintenance of the focused vision has been primarily the responsibility of the collaborative coordinator and her interaction with the director of mathematics. This dual partnership has been critical to the success of the collaborative in merging into the system. There is a question whether, as the coordinator reduces her role in the collaborative, the transformed organization as it now exists will be strong enough to resist gravitating toward more traditional forms of operation.

One feature of successful "small incrementalism" is that many of the strategic decisions for the collaborative were made unilaterally by the project coordinator, or with the input of very few individuals. For example, the collaborative's budget has been the sole responsibility of the coordinator--a major advantage in the management of the collaborative's fiscal affairs. This seems to be taken as a given by Pittsburgh teachers and has not been an issue with them, whereas in other collaboratives, input into the budget process has been important for teachers seeking some ownership in collaborative activity and management.

Reducing the number of people engaged in strategic decision making has also helped in the decision-making process. Centralized policy making has not been raised as an issue in Pittsburgh because teachers and others feel they have access to those who do this high-level planning for the collaborative. The ITLs meet regularly, are kept informed of collaborative-related issues, and have input to mathematics program decisions. Dr. Salmon-Cox and Dr. Briars have visited schools, attended meetings, and responded to individual requests to the extent that teachers have become acquainted with them and can let them know what is on their minds. The relatively small number of secondary mathematics teachers in the PPS, just over 100, has undoubtedly been a factor in building such trust.

An important reason for the teachers' acceptance of the coordinator's role has been a direct by-product of her approach. A district administrator attributes teachers' acceptance of the coordinator to her personality and the trust that she has gained from the teachers, ". . . I think Leslie's personality has enabled her to really be seen as an aid to those teachers, rather than [a case of] 'Tell me what the input is that you want to have, then after the conversation we are going to do what we had in mind, anyhow.'" Many teachers have noted the ease they felt in approaching Dr. Salmon-Cox with their concerns. She has made a point of being accessible to them by attending collaborative events and visiting schools. In fact, some teachers recognize an event as being associated with the collaborative if they see Dr. Salmon-Cox present.

Teachers also recognize the value of having someone from outside the district system serving as their advocate. This has been as simple as supplying refreshments for meetings (the district is prohibited by state law from doing this) to more complex tasks such as facilitating modem access in the schools. A member of the computer committee noted the importance of outside intervention, ". . . it helped a great deal having another person . . . who is considered fairly influential and knowledgeable, [having modems in schools] is entirely appropriate--'This is the kind of thing that the collaborative wants. . . . We are trying to promote communication and this will help our professional development . . .' If Leslie wouldn't have been there and been the type of person that she is, I am not sure that program would have ever happened . . ." The teachers have noted that Dr. Salmon-Cox has reduced her involvement; however, rather than viewing this negatively, at least one teacher interprets it as indication of the empowerment of teachers, "Leslie hasn't been involved as much as [she was] in the beginning. In the beginning she seemed to be, but as time went on she seemed to back off further and further and let teachers actually start to get things moving, get ideas going, and have their own ideas about what we should do. . . .She seems to really be pulling herself back and letting teachers run the show."

A third feature of the overall strategy is that the collaborative has consistently operated with a relatively low budget that has eliminated the need for major fund raising.

Some of the low-cost activities include the formation of committees, the strengthening of existing committees, and the allocation of funds for teachers to take advantage of existing professional development experiences. In 1986-87, for example, the coordinator and the director of mathematics worked to replace the inservices that had been under the jurisdiction of each school principal with cluster inservices. The cluster inservice days then were used for collaborative-sponsored activities such as industry site visits, or presentations on current trends in mathematics education. Since these inservices are mandatory, they provided a mechanism for the collaborative to reach all mathematics teachers at a very low cost. Teachers have noted the value in the cluster inservices of having mathematics teachers meet with each other and they are now more interested in districtwide inservices so that they can meet with mathematics teachers from schools throughout the district. Thus, the Pittsburgh collaborative has found a means for providing teachers professional development experiences without spending a large amount of the collaborative funding. This is in contrast with other collaboratives where significant amounts of the collaborative budget are allocated to pay teachers stipends to attend similar inservices.

The low cost operation has meant that people have not had to spend time fund raising, and consequently could devote more time to developing ideas and programs. The support of Partnerships In Education (PIE) has been a contributing factor to the collaborative's financial security. The Partnerships In Education program covers 60 percent of Ms. Bridge's salary and the collaborative 40 percent for the time she serves as the collaborative liaison. Such support has been provided by the Allegheny Conference on Community Development to the collaborative as "venture capital" and cannot be counted on for the long term. But because the PIE program has included low-cost activities and its events have been built into the district's standard program, their continuation will require very little outside funding or creative funding. Ms. Bunt felt that the teachers' union could be one source for gaining support of teachers' professional development through negotiating with the district. One factor in the empowerment of teachers is the initiative they take in convincing the union that the role of the collaborative and of other professional development experiences are important enough that the union should negotiate them via the contract process. Stressing the importance of having some "walking around" money, she said, "I don't think an effort like this can be done without money. . . .You do need money to make change. You need staff and staff translates into money."

One problem in the low-budget approach has been that a structure for raising funds has not been developed. Thus, if teachers or others want to mount a high-cost event, financial planning will have to be addressed along with program planning. This in fact happened during the planning of the Leadership Conference, to be held in the fall of 1990, for which teachers submitted a proposal to EDC for an Outreach grant. Another issue related to fund raising is that it has been used by some collaboratives as an occasion for collaboration among the different sectors in the larger mathematics community. The collaboration between Pittsburgh teachers and those in business has not been extensive and could perhaps have been strengthened through a joint effort to address financial questions.

In reflecting on the goals of the collaborative, it is clear that the secondary mathematics teachers have been energized. All of the over 100 secondary mathematics teachers have had involvement with the collaborative in some way. An estimated 40 to 50 have been very active in collaborative activities. Another 40 have been somewhat active and approximately 20 have only participated in what has been required. The main reason given for not participating in activities was lack of time because of other commitments, such as the need to be with family.

Of those teachers who are active in the collaborative, some have assumed initiative and leadership in instigating new school-based projects and curriculum studies. Others serve on district committees. Two, one teacher and one supervisor, have recently had an article or comments published in the *Mathematics Teacher*. Many teachers have increased their participation in professional meetings.

In the Pittsburgh community, there has been some increase in the awareness of secondary mathematics issues through presentations to the Steering Committee and the Allegheny Conference Committee, newspaper articles, radio programs, teachers' meetings with community leaders, and teachers talking with parents of middle and elementary students. It is difficult to judge whether or not this has resulted in greater public awareness of the importance of mathematics in students' educational development and in adults' professional lives--one of the stated goals of the collaborative. Other than the mechanisms that already exist, new links have not really been formed that will promote exchange and interaction among teachers and community leaders in business, industry, and higher education. To the extent that exchange has taken place, the events have tended to be isolated cases rather than evidence of working mechanisms that have been built into the system. The Steering Committee model as a bench mark for reviewing the achievements of the collaborative and its future plans, along with its small Executive Committee for strategic planning, have served well to program the activities of the collaborative and to link the enterprise as a whole to the larger community. Those who serve on these groups are knowledgeable about the mathematics program and what teachers are doing.

What has successfully been built into the system are committees of teachers engaging in program decision making. What is less evident is the degree of authority given these committees within the larger district system and the way these committees are viewed by the superintendent and the principals. It is hoped that the administrators regard the committees as important resources when addressing mathematics education issues in the district. It seems crucial to the stability of the evolving culture in mathematics education to establish new relationships with the district administration.

## Collaboration

As has already been noted, the major form of collaboration has been among teachers and between teachers and the district's mathematics director and supervisors. As one ITL remarked, ". . . one thing that the collaborative does to help is that teachers have gotten to know other math teachers around the city better." This is significant because before the advent of the collaborative and Dr. Briars, there had been very little interaction among mathematics teachers except within the schools, and even then interaction varied greatly among individuals. The cluster inservices, the collaborative gatherings, the working committees, and the ITL groups all have contributed to mathematics teachers becoming acquainted with each other, becoming more comfortable with each other, and working together. The committees that have been strengthened or initiated through the collaborative are cited by teachers as substantive factors in the increased collaboration they experience among their peers. The value of having teachers serve on committees was explained by an ITL, ". . . so you get to know somebody from each building and then they talk about their buildings and you get to know what they are doing and what is happening around the system. Even if it has nothing to do with math, it helps you get more of a city-view of what is going on rather than just what is happening in class."

The Computer Committee is a good example: its members interacted with each other outside of meetings as they developed their plans, wrote materials, and explored different software packages. The chair reported that the Computer Committee was very effective, "It worked on a number of levels. It worked on a level of inservicing teachers and turning teachers and their approach towards teaching completely around. It worked on the level that it has gotten the computer out in the schools and used by students when I didn't think it could. And I think it also worked on kind of a curriculum level because those people that are using it do push their curriculum in that direction." That service on the Computer Committee changed his teaching was confirmed by a Committee member who reported doing more to encourage students to make their own conjectures. In this and other ways, he became more willing to try new ideas, "I think [the collaborative and the Computer Committee] has made me become a better teacher because I am trying out a lot of things."

Clearly the formation of teacher committees is one way of motivating collaboration among teachers, but this approach does not seem to be as effective for generating collaboration among members of the group at large. For example, the members of the Computer Committee tried to get other teachers at each of their schools more interested in using computers in their classrooms. This, in general, has not happened. The enthusiasm of the members of the Computer Committee and actual use of computers have not spread widely among other teachers. This can be attributed to two factors: the difficulty teachers have had in gaining access to computers and district policies that have located a large number of computers in a few high schools, while leaving some mathematics departments with only one departmental computer and large screen monitor. Members of the Computer Committee did give a course that was well received to a few other teachers.

The difficulty of extending the enthusiasm generated among committee members to other teachers is also applicable to the ITL group. The members of the ITL group have evolved both as a group and as individuals. This is evident in the decisions being made by the group to set policy for the use of calculators, address assessment issues, and plan inservices. But the energy and the growth of the ITLs has not, in general, been transferred to the other teachers. A mathematics supervisor admits, ". . . [the ITLs] are a group of people who got together,. . . had a task, got involved, got excited, created something, but have not been able to translate that energy to other people."

An important factor in the evolution of the groups formed through the collaborative has been that each has had significant tasks to address. By working on these tasks, the members of the group have become involved, they have gained knowledge, and they have bonded with other members of the group. The Director of Mathematics has identified individual growth as being an important outcome of the collaborative, ". . . it's not necessarily a particular project, it is how particular individuals have really grown and changed . . . that is going to stay around." The objective in using committees to energize teachers appears not to be that of spreading committee members' enthusiasm to other teachers or forming second committees, such as a second computer committee, but to engage teachers in committee work in which each group has a unique, well-defined task to accomplish.

One benefit teachers have realized as a result of collaborative participation has been that of interacting with teachers from other cities who are in situations similar to theirs. The increased interaction of Pittsburgh teachers and staff with the larger UMC network of teachers has been facilitated through Bread Board, the UMC electronic bulletin board. By the end of the 1989-90 school year, 30 or more teachers were reported to be enrolled on the system. This was increased to 70 during the present school year. Some teachers noted that they have read messages on the system. Two teachers and a mathematics supervisor were very active in interacting on the system with other teachers regarding issues such as equity, assessment, and geometry. One commented that he valued this interaction because it directly related to "how to do things right" and "how to be a better educator." Attending meetings and being involved in other interactions between Pittsburgh teachers and those in the larger UMC network was one way that an ITL reported that the collaborative had enhanced his professional life, ". . . it has changed my outlook on being a teacher, from looking at things from a building perspective and my classes to looking at things system-wide and nationwide."

Collaboration among teachers and those from business and higher education has been restricted to a few events. In these cases, those from business or higher education have been used as resources, describing for teachers what they do. The business and teacher interaction has not been a matter of members of these groups working with each other cooperatively, each bringing his or her particular expertise to bear on the situation or into the discussion; rather, the events they shared have included site visits to industries and discussions with those from higher education. Some teachers have expressed appreciation for these interactions and have valued the knowledge they have gained about the applications of mathematics in the world of work and the mathematics expectations for employees. But not all teachers found them to be of value. One teacher felt the business site visits were too general, the insights gained were trivial, and the interaction did not really enhance his knowledge about what was important to him, becoming a better educator. The fact that the site visits were only arranged twice (once with secondary and once with middle school teachers) also indicates they were not given as high a priority as other activities. Teachers do have the opportunity to interact with those from business through the Partnerships In Education program that links each school with one or more businesses or corporations. The business visits have given teachers the experience of being treated positively by those from business and a sense that they are valued.

The collaborative has brought the agenda of mathematics education to the attention of chief executive officers of the major corporations in Pittsburgh. The Executive Committee of the Allegheny Conference is formed by 26 CEOs of the largest firms in Pittsburgh. At one of their quarterly meetings, they were briefed by Dr. Salmon-Cox on the mathematics collaborative. The reaction as reported by Mr. Wilburn, president of the board of the Carnegie Institute and the chair of the collaborative steering committee, was mixed and predictable. "On the one hand, it isn't that great; however, it is sort of nice to see that sort of progress. But what about these bigger problems and how is this going to solve the bigger problems of education?" Mr. Wilburn explains that it is difficult for these people to understand that "there are a thousand buttons that you have to push" to move things forward in education. He has been impressed with the accomplishments of the collaborative and in this way has provided encouragement to the coordinator. "Leslie and I talked about the number of teachers involved and I viewed it as a success. . . .From my background (former Secretary of Education for Pennsylvania), I thought it was phenomenal to get half the mathematics teachers in the city in one way or another involved . . . .I think that is quite an achievement to have that kind of an impact." Mr. Wilburn felt that getting the business community involved in the collaborative and with teachers has been one of the most difficult parts of collaboration. He feels that the support of CEOs is important, but that the really meaningful commitments will come from those at the middle level. The way to interest business people, according to Mr. Wilburn, is to talk to them one-on-one and make a specific request of them . "You call an individual, identify him by name, and give him a specific assignment that you want him to do." People in education seem reluctant to make specific requests, Mr. Wilburn explained:

"We want people to volunteer and so we keep putting the call out and thinking that if you put a call out people will respond to it. It just doesn't happen for whatever reason. I think you really have to give it a very specific assignment."

**Professionalism**

The greatest impact of the collaborative, as reported by teachers, has been an increase in the professional activities of teachers and in their empowerment. Because of the collaborative, teachers report being less isolated, feeling as if they are a member of a professional group with common goals and interests, being more informed, more willing to participate in professional activities, and experiencing increased sharing among teachers. In these ways, the climate for mathematics education in the district has changed so that mathematics teachers are more willing to consider deviating from the status quo. Since the collaborative was initiated at the same time the current director of mathematics was appointed, it is difficult to distinguish the singular impact of one or the other. But as the collaborative has strived to merge with the district, teachers and others cite it as a factor in creating the positive environment in mathematics education that now exists in Pittsburgh. For Ms. Bunt, the most important outcome of the collaborative has been the empowerment of teachers, "Just from what I have personally seen in terms of teachers who have come and spoken to the Steering Committee, there are teachers who recognize that they need to be part of the solution and that they are very interested in figuring out what that solution is. . . .You have math teachers now who are really struggling with how they can develop a math-literate student body and who are willing to tackle methods and techniques that they might not have heard of before this."

An associate superintendent has observed a difference in the attitude of secondary mathematics teachers. In the early 1980s, the district had tried to work with teachers in an effort to reduce the number (over 30) of different mathematics courses that were being offered and to offer algebra to all students before graduating. The teachers resisted this change and little progress was made. Since the collaborative became established, the number of mathematics courses has been reduced to 15 and the three tracks--academic, skill, and general--have been reduced to two, academic and skill (vocational). This superintendent gives the collaborative credit for contributing to the creation of an environment in which mathematics teachers are much more receptive to change.

Teachers have valued the funding they have received through the collaborative, such as the Professional Education Grants. These grants have given them the opportunity to attend professional meetings, some for the first time. Opening these doors has enabled teachers to make presentations at professional meetings and to write articles for professional journals.

Dr. Briars has promoted shared decision making. She has formed a variety of curriculum committees and pilot studies to engage teachers in choosing textbooks and other curriculum materials for adoption. The secondary ITL group that was energized as a result of collaborative activities has conformed well to this model. The department heads who formed the ITL group felt that they had been involved in important decision making. This group also has had greater input into district assessment practices and tests than it did prior to the advent of the collaborative. Because the ITL group is functioning so well, the individual department heads are more willing to convey information back to their departments and to get input from their colleagues. The ITLs also were important in developing a strategy for increasing collaborative impact on classroom practices. As a follow-up to one inservice, ITLs were asked to work with their departments to develop intervention plans. In these ways teachers, other than department heads, have input into decision making.

One way in which the collaborative has aided the ITLs in effecting change has been in helping them to acquire greater skill in working with other teachers. The main training that ITLs had received through the district before the collaborative existed consisted of observing teachers and giving them feedback on their teaching. To become an ITL requires being nominated by the department and then appointed by the principal. This meant that ITLs had to fit in with the other teachers and be acceptable to the principal, both factors that put pressure on them to be more conformists than leaders. Increasingly, the ITLs group serves as support and a source of information for its members so they may become leaders within their departments rather than primarily observers.

Teachers have responded to the challenge of heightened professionalism in different ways. For some, as has been noted, they have become more involved in professional organizations. One teacher has become more assertive in trying to address problems of absenteeism and achievement. She attributes this change to the training she has received through the collaborative. She initiated a study of the relationship of failing grades, attendance and ethnicity. She got 60 percent of the teachers in her school to collect information for one grading period, then compiled the data, prepared graphs, and made a report to her principal. The data indicated that of the students who were absent less than 10 days during the period, a greater percentage of white females failed than did white males, black females, or black males. Whereas the district was expressing concern that an excessive proportion of black students were failing, the data collected suggested that failing grades were related to absenteeism and not necessarily to bias or the ineffectiveness of the teachers. To help solve the absenteeism problem, she organized a meeting of community leaders, parents, and business people. From the 161 invitations sent, nearly 20 people came to discuss the issue. Being active in the collaborative motivated this teacher to take initiative, something she had never done before. Her initiative has caught the attention of Ms. Bunt, who sees it as one way teachers, through the collaborative, can become part of the solution in resolving mathematics education problems in urban schools. For her the collaborative has broadened the vision of teachers, helping them recognize that they have to be actively involved in change as well as being able to identify problems. "Absenteeism, multicultural aspects of math education, is a real issue that has got to be brought to the forefront."

Mathematics teachers who have been active in the collaborative also feel that it has enhanced their professionalism. One teacher described the collaborative as a professional organization that has helped to make her think of herself as a professional. Previously, she viewed herself as a teacher--a term that did not have such a good connotation. What has made the difference for her are the relationships she has formed through the collaborative with other mathematics teachers. Others feel that the collaborative has kept them informed of the current trends in mathematics education. This increased knowledge contributes to the teachers' sense of professionalism. There are teachers who have not been reached by the collaborative and are described by other teachers as "not being very professional." These are the teachers who tend to spend a minimal amount of time in school.

Attempts were being made during 1989-90 to expand the interest generated among many of the secondary mathematics teachers to teachers in the lower grades. Although joint meetings of the secondary and the middle school ITL groups were held along with social gatherings, extending the collaborative's impact on the secondary teachers to all teachers of mathematics across the grade levels seems to represent challenges similar to those that existed at the beginning of the collaborative.

**Mathematics Focus**

The Mathematics Focus of the Pittsburgh Mathematics Collaborative remains the same as that of the district. Dr. Briars has been very influential in setting the direction of the mathematics program in Pittsburgh. She has had the support of the district administration and has gained the support of the ITLs. During the period the collaborative has existed, which corresponds to the tenure of Dr. Briars, several changes in the mathematics program have been implemented or are in the process of being implemented. Current national reform initiatives inform the changes. As one active collaborative teacher observed, "Everything we do is based on the changes [advocated in] in the *Standards*."

The total number of mathematics courses listed by the district has been reduced by half and now is approximately 15 courses. This reduction resulted from the elimination of multiple mutations of general mathematics. A problem-solving course developed by a committee of teachers has replaced the former general mathematics course given to 9th-graders who were deemed unprepared for algebra. Rather than being driven by computation, the course presents students with a range of mathematical experiences including some statistics, problem solving, graphing, and equations. The expectation is that most students will take Algebra I following the first problem-solving course. There will be a Problem Solving II course for those who do not. The collaborative has provided teachers with professional development experiences such as inservices and opportunities to attend conferences that have helped to create the climate for and interest in reform. This has made the teachers much more receptive to change.

The collaborative has helped to increase the use of technology by secondary mathematics teachers. The Computer Committee has reviewed a range of software applicable to the teaching of mathematics. The Committee, composed of one member from each high school, is available to help other teachers become more comfortable with using computers in class. The result is that computers are being used more widely, primarily by those on the Computer Committee, but to a certain extent by other teachers also. The collaborative helped finance an initiative that enabled every high school mathematics teacher to have classroom calculators. Inservices have been offered that demonstrate the use of calculators, such as the one given in June, 1990, by Professor Demana. A course has been developed around the use of the graphing calculator. Whereas one of the first tasks given the ITLs was to develop a policy statement on the classroom use of calculators, calculators and other forms of technology are now integral to the mathematics program in Pittsburgh. The collaborative has facilitated this change.

Teachers are using each other more as resources. This includes their interaction on the Bread Board. For example, one teacher was given $70 by her ITL to spend on some materials. "I didn't have time to be rooting through all the books so I said to the Bread Board," she explained, " 'I have $70 to spend on my calculus class. Anybody have any ideas?' I got a batch of things in one day. 'Try this.' 'Try This.' 'Try this.' That's phenomenal." Teachers have shared materials they have developed and are working with each other in piloting textbooks to assist them in deciding what books to adopt--a strategy already used for geometry, and for trigonometry, analysis, and statistics (TAS). All of these actions reflect the most current trends in mathematics education toward increased use of technology, problem solving, and reasoning in the mathematics classroom.

## F. Next Steps

As part of their implementation of the Outreach grant from EDC, the Pittsburgh Mathematics Collaborative has scheduled a retreat/conference for approximately 40 teachers for November, 1990, at the United Steel Workers Union Retreat. At the conference, the teachers will receive training in inter-personal skills and also work to further develop department action plans. Between November, 1990, and February/March 1991, the action plans will be refined and implemented. At the cluster inservices for all mathematics teachers held in February and March, 1991, teachers will share their action plans and revise them based on what they learn from the discussions.

Pittsburgh secondary collaborative mathematics teachers can avail themselves of the five-day Woodrow Wilson National Fellowship Foundation Summer Institute at Duquesne University August 6-10, 1990. The Institute will explore mathematics as it is applied in the human decision-making process. Middle school mathematics teachers will be given the opportunity to visit businesses as in the previous year.

# SUMMARY REPORT
# ST. LOUIS URBAN MATHEMATICS COLLABORATIVE
by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the progress and activities of the St. Louis Urban Mathematics Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the extent to which the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Mathematics and Science Education Center to the Ford Foundation for continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district; and one site visit by the staff of the Documentation Project.

## ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

### A. Purpose

As stated in the 1986 funding proposal to the Ford Foundation, which was produced with the active involvement of a group of secondary mathematics teachers, the overriding goal of the St. Louis Urban Mathematics Collaborative is to foster a spirit of collaboration among St. Louis Public Schools mathematics teachers, university mathematics professors, and mathematicians from local business and industry. The collaborative's primary goals, as stated in the funding proposal, are:

1. Teachers will explore potential resources among businesses, industries, and universities to discover how these resources may assist them in their own professional growth and in their classroom instruction.
2. Teachers will specify the need for, assist in organizing, and implement staff development programs for themselves and for their peers.
3. Teachers will assist in improving communication and exchanges of information among all mathematics teachers within each school and across schools.
4. Teachers will promote the recognition of accomplishments and quality performance among all mathematics teachers and students.

The permanence proposal for funding through the 1991-1992 school year was prepared over the time period extending from May, 1989, to April, 1990, when it was submitted to the Ford Foundation. This proposal was approved in April, 1990. Some changes in the structure of the collaborative and its goals were implemented in 1989-90 and reflected in the approved proposal. In 1989-90, the St. Louis Urban Mathematics Collaborative expanded to include mathematics teachers in the middle grades (6-8) and offered programs directed specifically toward this population. The goal of the collaborative as presented in the permanence proposal was succinctly stated in one sentence:

> To facilitate a wide range of programs and services which enhance mathematics education through professional interaction among mathematics

> teachers, staff development, curriculum implementation, and community business/industry networks (p. 2).

The intention of the collaborative is to continue to increase the number of teachers who are involved and expand the programs that are offered. In 1989-90, middle school teachers were included at the same time that an effort was being made to establish additional business/industry contacts. In 1990-91, the plan is to target more preservice and novice teachers and to increase the support and materials that all district mathematics teachers have available to them. In the coming year, 1991-1992, the collaborative will assist in the development of expanded curriculum and programs for students in new magnet schools and will invite teachers in selected school districts to join St. Louis Public School teachers in staff development activities.

## B. Context

The City of St. Louis has a population of approximately 410,000, with the population of the metropolitan area exceeding 2 million. There were 46,128 students enrolled in the St. Louis Public Schools (SLPS) in the fall of the 1989-90 school year. Seventy-seven percent of the SLPS student population is black, 21 percent is white, and a little over 1 percent is Asian. Less than 1 percent is from other ethnic groups. Eighty-five percent of the student population is eligible for federally-funded lunch programs. The student-teacher ratio ranges from 22:1 in elementary schools to 28:1 in the high schools. Thirty percent of the students in the district attend private or parochial schools.

The district has eight senior high schools; enrollments range from approximately 500 to 1,500, with an average of 980 students. In 1989-90, there were 11,435 students enrolled in the district's high schools. Seventy-seven percent of high school students are black, 21 percent are white, and nearly 2 percent are Asian. Approximately 68 percent of the high school students were enrolled in mathematics courses during 1988-89. Students in the St. Louis Public Schools are required to have at least three years of mathematics to graduate.

In 1989, one in five freshmen in SLPS high schools failed to earn enough credits to become a sophomore, and one in six dropped out. The yearly dropout rate in the SLPS high schools is nearly 14.5 percent, up from 13 percent in 1988. Most of the students who dropped out in 1989 were freshmen. In high school, students who do not earn credits enough to pass are held back, thus the 9th-grade has become a holding point for students likely to drop out. Many of these students are still in 9th-grade when they turn 16, at which time the law no longer requires them to attend school. During the 1989-90 school year, the SLPS started a program to reduce the exodus of its students. A special intervention counselor was hired in each of four high schools. The counselors have each selected 100 low-achieving students who they feel could benefit from extra attention and support. The SLPS is using federal funds to pay for the program.

This year the district replaced the California Achievement Test (CAT) which it had used since 1980 with the Stanford Achievement Test (SAT). The SAT is somewhat longer than the CAT, and measures a greater number of subjects and skills. Although student scores on the SAT were lower than the national average across all grades, performance based on national norms was higher than the performance of St. Louis students the previous year, based on national norms for the California Achievement Test. The scores on the SAT, according to school officials, reflect higher standards rather than lower student achievement.

Thirty-five percent of 1989 graduating seniors in the SLPS district took either the ACT or the SAT. Students scored, on average, 414 points on the mathematics portion of the SAT compared to a national average of 476, and a Missouri average of 518. SAT mathematics scores were up 14 points since 1988. ACT scores averaged 14.6 overall, also up from 1988. In mathematics, ACT scores averaged 12.2, compared to the national average of 18.6, and the Missouri average of 19.0. About 51 percent of high school students go on to post-secondary education.

As part of a school district desegregation case, the city established a districtwide magnet program to promote racial integration. The magnet program is designed to attract students from the city and county who are interested in a more focused course of study. Twenty-nine schools are included in the program. These include comprehensive high schools that offer general college preparatory courses; schools that emphasize international studies; foreign language and communications; health careers; fine arts; mathematics and science; air force and naval academies; programs designed exclusively for gifted students; and several that have unique programs; such as Montessori, individually guided instruction, and action learning and career exploration.

The magnet program, which is extremely popular, has attracted more applicants than can be accommodated. Consequently, beginning in September, 1990, a lottery system for enrolling children in St. Louis magnet schools will replace the queue process that the system is currently using. Previously, parents had to camp out in front of the district's recruitment office prior to registration to ensure that their children would be placed in a magnet school. The new selection system will give everyone an equal chance. The school system currently has a capacity for 9,200 students in its 29 magnet schools. In 1988, the U.S. District Court ordered that the capacity of the magnet program be expanded to include 14,000 students by the 1992-93 school year. The magnet schools were established under a desegregation order that required special programs to attract children to integrated schools. Students are accepted on the basis of racial and residential priorities with the goal of keeping the student body approximately 50 percent white, 50 percent black. As a result of the lottery, 1,872 new students are being placed in the magnet program for the 1990-91 school year; the 2,876 students who were rejected are being assigned to their regular schools.

Approximately 3,500 teachers are employed by the SLPS district. Twenty-one percent are males and 79 percent are females. Sixty-seven percent are black and 33 percent are white, while less than 1 percent originates from other ethnic groups. Eighty-five middle school teachers teach mathematics. Eighty-four percent are females and 16 percent are males. Seventy-seven percent are black and 23 percent are white.

The SLPS employs 114 high school mathematics and computer science teachers. Forty-six percent are males and 54 percent are females. Forty-nine percent are black, 46 percent are white, and 5 percent represent other underrepresented groups.

The minimum salary for SLPS teachers is $21,110 for beginning teachers with a bachelors degree; the maximum salary tops $40,500 for teachers with a Ph.D. The average salary for the 1989-90 school year was $29,326. Mathematics teachers receive an average salary of $32,400. Ninety-one percent of mathematics teachers are tenured. Teachers receive four paid inservice days per year.

In August, 1989, the school employees' union, the St. Louis Teachers Union, voted to ratify a contract for the 1989-90 school year for teachers, paraprofessionals, and secretarial/clerical employees in the public school system. The local teachers union, an affiliate of the American Federation of Teachers (AFL-C10), is the exclusive bargaining agent for the over 5,000 employees in the system. Under the contract, teachers were given a five percent increase. Teachers also received a small increase in take-home pay in April, 1990, as a result of an employer pick-up rule that deducted retirement contributions from employees' salaries before taxes rather than after taxes.

In September, 1989, the 12-member Board of Education imposed a hiring freeze that could potentially reduce the school system's staff by 200 employees a year. The freeze--tied to budget reductions--will be lifted if the budget is cut by at least $30,000,000 over the next three years. The teachers' union filed a lawsuit against the Board of Education, stating that the freeze could harm the quality of education in the SLPS.

St. Louis School Superintendent Jerome B. Jones informed the school board of his intention to resign June 30, 1990, a year before the expiration of his contract. During his tenure, Dr. Jones made a number of improvements in the system. When he came to the district in 1983, the system was in financial distress, student test scores were far below national averages, and class sizes ranged as high as 45 students. Since 1982, class sizes have been reduced to an average of 20 to 25 students, voters have approved several tax measures to fund school improvement, student test scores have risen, and the district has begun a $114,000,000 program to renovate 104 schools. Many of the improvements were ordered by the U.S. District Court as part of the St. Louis desegregation case. The superintendent's resignation announcement came a week after the school system won voter approval of its first bond issue in 28 years.

For the 1990-91 school year, Superintendent Jones will be replaced by interim Superintendent David Mahan, previously the assistant superintendent for middle schools. Dr. Mahan has been involved in education since he started teaching in 1958. He has served in several positions in the St. Louis Public Schools for the past 17 years. A particular goal of Dr. Mahan's is to improve instruction in science and mathematics. The target date for finding a permanent superintendent is January, 1991.

Nearly six months into the 1989-90 fiscal year, the St. Louis School Board adopted a budget over the objections of Superintendent Jones. The approved budget totaled $233,300,000 with an anticipated year-end surplus projected at $10,000,000. The budget called for Jones to cut $4,800,000 in operating expenses from the budget he presented in

June. The operating budget included $8,175,000 for court-ordered capital improvements, $7,300,000 for additional capital improvements, and $4,800,000 as the system's first payment on $50,000,000 in lease-hold revenue bonds the board had sold earlier in the year. Total district expenditures for the 1989-90 school year approached $300,000,000. leaving a large budget deficit. Forty-two percent of the district funds come from local revenues, 48 percent from state revenues, and 10 percent from federal revenues. The projected district budget for the 1990-91 school year is $355,000,000.

In January, 1990, the school board voted to put a $100,000,000 bond issue for school renovation on the April ballot. Superintendent Jones had recommended an issue of $200,000,000 to cover all capital improvements ordered by the U. S. District Court, to pay off the lease-revenue bonds that the Board sold last year, and to make other improvements that the Board felt necessary. The $100,000,000 compromise would require a city property tax increase of about 33 cents per $100 of assessed property valuation. The issue was approved by voters in April. The last time St. Louis voters approved a bond issue was in 1962. In June, 1990, a vote to forego the property tax roll-back did win approval. The vote was later disqualified because of a technicality that violated a state regulation requiring that bond issues be passed by a majority of the voters only at a regular municipal election. The April vote was taken on the date set aside for a municipal election, but an election was not conducted. At the time of this report, the matter was still being reviewed by the county.

Federal Judge Stephen Limbaugh, who has been overseeing the desegregation effort in the St. Louis schools, ordered the Board of Education and the state to work together to produce a workable plan for reassigning students and consolidating schools. The judge warned that unless the Board and the state can jointly develop a better plan, he would appoint a committee to do the job. Both the state and the Board had submitted plans for reassigning students and consolidating schools; however, the judge felt that the state plan lacked a human touch and that the Board plan was based on "bogus" data. The SLPS Board and the State of Missouri did agree on plans to streamline the city school system. The joint proposal calls for renovation of 35 schools, necessitating the reassignment of nearly one-fourth of the district's students. The average age of buildings in the school district is 60 years, and some buildings are more than 100 years old. The district's share of court-ordered improvements, $8,800,000 per year, will come out of the operating budget, as will the payments for $50,000,000 of lease-hold revenue bonds, $5,000,000 per year for 20 years. Other provisions of the agreement include: reducing the pupil/teacher ratio in elementary schools to 20 students, improving integrated school settings, and downsizing the school system to make it more efficient. In addition, there were plans to close or mothball 14 elementary schools by the 1992-93 school year. The agreement is in concordance with Judge Limbaugh's capital improvements plan issued in 1987. In June, 1990, the Board and the state recommended closing 18 elementary and four middle schools in order to streamline the system.

Judge Limbaugh ordered the Special School District of St. Louis County and the St. Louis Public Schools to run separate and competing vocational educational programs. His decision was the result of the seven years of conflict between the school systems that had frustrated efforts to get students to attend programs in integrated schools. The judge said the time had come for a new theory that focuses on better education instead of integration. A deadline of September, 1990, was established by the judge, and the SLPS faced the question of whether it would be able to move the vocational facilities to a different site.

## Community Support

The St. Louis Public Schools receive a great deal of support from community resources. The St. Louis Regional Education Partnership sponsored a meeting in September, 1989, to develop a plan to improve the quality of education in the St. Louis schools. The conference, which was attended by over 900 educators, business and community leaders, and students, was held on the same day that President Bush conducted his "education summit" with the country's governors. Issues discussed at the conference included the need for more volunteers in classrooms, increased involvement of parents, and better neighborhood school buildings. The organizers of the conference said that the event differed from previous gatherings in the diversity of these who attended and their high level of commitment to follow through with action. The St. Louis Regional Education Partnership made a 10-year commitment to work on improving education in the St. Louis Schools.

Although the state is the primary source of funding for computer equipment at magnet and racially isolated schools, several area businesses have assisted the St. Louis Public Schools in their efforts to obtain computer equipment. Civic Progress, a group of St. Louis corporations, have pledged their support to the city's schools. In addition to conducting on-site visits, they have donated computers and software to expand the Writing-to-Read program in 24 integrated schools in St. Louis. To help provide computer equipment for the schools, Schnucks Markets, Inc., began an "Apple for the Students" program, in which students collect cash-register tapes, the totals of which are used as a basis for the donation to the schools of computer equipment. More than 1,000 metro-area schools have signed up for participation in the program. Eighty-five thousand dollars worth of grocery tapes will buy an Apple IIc color computer. Schools may also choose software, printers, disc drives, or other computer equipment. Through the program, Schnucks has already provided more than $1,000,000 in computer products to area schools. Dierbergs Markets also began a "Partners in Education" program whereby each school gets one percent of the amount of money represented by sales tapes collected, excluding sales tax. Seven hundred schools have signed up for their program and more than $9,000,000 in tapes has produced checks totaling $90,360 to the schools. Volume Shoe Corporation, the operator of Payless Shoe stores, donated $3,000 to Banneker Elementary School. The gift will be used to purchase computer equipment for student use.

The Maritz Corporation has pledged to spend as much as $1,000,000 on a new incentive program entitled, "Be There," to improve student attendance. The company, which designs programs that help organizations and businesses motivate and improve the performance of employees, donated its services to the school district. Bill Maritz, chairman of the corporation, explained that he had been told that, on average, one fifth of the students enrolled in St. Louis high schools were absent on any given day. "If they're not there, they're not learning, " he remarked. In addition to increasing individual successes through better attendance, a 5 percent increase in the average daily attendance would mean $2,500,000 more in state aid to the district. Results for the first half of the school year showed that 73 schools (61%) of the 120 schools participating, exceeded their attendance rates for the same period in 1988-89. In February, 11,700 St. Louis middle and high school students enjoyed a rap concert as a reward for the increased attendance rate. The event also included the finals of a rap contest for SLPS high school students that centered on the "Be There" attendance theme. Students participating were either from schools with increased attendance, or they had achieved perfect attendance at other schools in the system. By the end of February, 91 (or 76%) of the 120 schools had improved their attendance record, resulting in an increase in the amount of state aid to schools by over $400,000.

Ranken Technical College established a summer course in 1989 in order to give St. Louis high school students an opportunity to become more computer literate. Mathematics and business education department heads at each high school were asked to recruit students for the summer program, and the mathematics curriculum supervisor was asked to assist in the implementation of the project. The instructor was John Hulse, a former SLPS mathematics and science instructor. Twenty-five students were accepted for each of the two two-week summer sessions.

In October, 1989, the National Science Foundation (NSF) awarded $3,700,000 over a five-year period to a consortium of five local institutions to establish the Regional Science and Technology Career Access Center for Minorities (RCAC). The Center, which is housed at the University of Missouri-St. Louis, is a joint effort of the University of Missouri-St. Louis, Harris Stowe State College, St. Louis Community College, the University of Missouri-Rolla, and the SLPS. The purpose of the Center, one of four in the country, is to establish an ongoing program to increase the number of members of underrepresented groups who choose and successfully pursue careers in science and technology. The RCAC provides a variety of programs including a mathematics enrichment program for elementary and middle school students; science, mathematics and engineering clubs; and a summer mathematics and science academy designed to assist 10th- and 11th-grade students in developing the self-confidence necessary to succeed in science and mathematics.

**Special Programs for Students**

Each summer, the University of Missouri-St. Louis sponsors the Engelmann Mathematics and Science Institute. Fifty outstanding St. Louis area high school students who have completed their sophomore or junior year are selected to participate in a month of academic study free of charge. The designated Engelmann Scholars must rank in the upper five percent of their high school classes and demonstrate aptitude for and interest in science or mathematics. The program was initiated as a tribute to George Engelmann, a nineteenth-century scientific scholar and physician who was the founder of the Missouri Botanical Garden and co-founder of the St. Louis Academy of Science in 1856.

The Cooperative Minority Engineering Transfer Program (CMETP) is a joint venture of St. Louis Community College and the University of Missouri-Rolla. It is designed to attract and support promising students from underrepresented groups who want to enter the fields of engineering and computer science. The students are required to follow a pre-engineering course of study at St. Louis Community College for two years and then transfer to the engineering program at the university. Once accepted at the university, students take summer courses that give them remedial or advanced credit in mathematics, English composition, and chemistry, depending upon their achievement level. Tutors are available for those in need of special help. Special seminars with industrial representatives and engineering department chairs describe the opportunities and types of work done by graduates in the field. The summer program is free of charge and students receive a small stipend for out-of-pocket expenses.

The 1989-90 School-Community Connection Forum of the SLPS was held at the end of February. The program was sponsored, in part, by a $22,000 grant from Southwestern Bell. The program awarded a total of $15,000 in student scholarships and $7,000 for adult education efforts. This was the fifth year of funding by the company for the $1,000 scholarships and $500 classroom grants. The theme of this year's forum was "Education and Economics."

## Professional Development Opportunities for Teachers

Many of the institutions in the St. Louis area provide opportunities for the professional development of St. Louis teachers. The Mathematics Science Education Center, the collaborative's host agency, sponsored several seminars and symposia over the 1989-90 school year. The Center also sponsored a series of site visits to Sverdrup Corporation, a leading national engineering firm headquartered in St. Louis. The site visits were designed to enable teachers to observe the latest in research and technology. The tours were targeted for science, mathematics, and computer technology teachers.

In March, 1990, Citicorp and the Network for Educational Development, a consortium of cooperating school districts, initiated a teacher mini-grant program. The Citicorp Success Fund encourages innovation and the sharing of successful teaching programs geared to "at-risk" students. Grants of $500 are awarded to 40 teachers who present their ideas through workshops, demonstrations, and videotapes. A second round of grants will support 60 "adaptor" teachers who will take one of the grant-winning ideas and shape it to their own classroom programs. Each recipient of an adaptor grant will receive $100.

St. Louis teachers have the opportunity to earn advanced degrees through a variety of programs, including one funded by the Parson Blewett Foundation, which was established in honor of a former school superintendent. Textbook publishers have sponsored inservice activities for mathematics teachers, and Title II funds, which are available for mathematics and science activities, have been used to sponsor teachers' attendance at professional development seminars held after school hours.

An innovative teacher leadership program, The Teacher's Academy, was initiated during the 1989-90 school year. The Academy, sponsored by the Network for Educational Development, offers a fellowship program for classroom teachers with five or more years of experience. Action research, planned and implemented by teachers, is one of the most challenging and rewarding aspects of the year for Academy fellows. The Academy program also includes studies of education issues and of the change process. Gloria Fairchild, a teacher and member of the pilot class, said, "The Teachers' Academy is the most significant thing that's happened to me as a teacher."

## C. Development of the Collaborative

The collaborative is funded through the Mathematics and Science Education Center (MSEC), which raises funds and develops programs to support science and mathematics education in the greater St. Louis area. The Center continues to be administered by Dr. Paul Markovits, who has been the Center's director since 1986. The MSEC is governed by a Board of Directors. The MSEC has allocated funds to the collaborative and provides the collaborative with bookkeeping, accounting, secretarial, clerical, printing, phone, and mail services. Beginning with the 1988-89 school year, the Center established a full-time mathematics coordinator. Half of the coordinator's responsibilities were devoted to management of the mathematics collaborative. The collaborative and MSEC offer programs jointly and both make a concerted effort to involve collaborative teachers in MSEC programs and projects.

The main decision-making body for the collaborative is the Collaborative Council. The number of members on the Council is not fixed, but varies depending on who expresses interest in serving. The Council develops the goals and programs of the collaborative, relying on the MSEC's program when it serves a specific collaborative need. During 1989-90, the MSEC mathematics coordinator and collaborative director was Jerome Burke, who had previously been one of three mathematics supervisors for the St. Louis Public Schools. He continued in this position until August, 1990, when he took a teaching position at Normandy Senior High School in the Normandy School District. The previous collaborative director was Dr. Helene Sherman, who resigned her position effective August 31, 1989, to accept a faculty position in mathematics education at the University of Missouri-St. Louis.

In the middle of February, 1990, two part-time collaborative coordinators were added to the collaborative staff. The appointments for the coordinators, Cyrus Rodgers (a teacher from Stowe Middle School) and Gloria Clark (a teacher from the Center for Management, Law, and Public Policy, a magnet secondary program), extended through the end of May, 1990. These coordinators were to assist in developing and implementing programs for the collaborative, including: activities that encourage participation of the middle school mathematics teachers in collaborative activities and that foster sharing and cooperation between the middle school and secondary school mathematics teachers; activities that enhance the professional interaction and development of collaborative members; and activities that focus on preparing collaborative members to carry out the goals of the collaborative as stated in the permanence proposal. The hope is that during the 1990-91 year, the St. Louis Public Schools will see the value of having a teacher as a coordinator and, as an in-kind contribution, release a teacher half time to serve as coordinator.

In addition to the collaborative director and two part-time coordinators, the MSEC provides a half-time secretary to the collaborative. Donald Thompson, a mathematics teacher at Soldan High School, is the collaborative's on-site observer.

## Collaborative Council

In the proposal for permanence submitted to EDC on November 9, 1989, the Collaborative Council was described as "a voluntary council that is the decision-making body, consisting of approximately 16 persons who meet on a monthly basis to discuss issues and plan support activities and opportunities for mathematics teachers." At the beginning of the school year, 19 Council members were identified: 1 business representative (William Carroll, CNA Insurance), 2 higher education representatives (Richard Friedlander and Helene Sherman), the district supervisor for mathematics (Winifred Deavens), a trainer from the Division of Technology Development (Linda Schweiss), 1 district division administrator (Wayne Walker), 12 secondary mathematics teachers (Gayle Coleman, Paula Eschmann, Ali Khan, Anita Madsen, James Richmond, William Stadtlander, Donald Thompson, Jeannie Wells, Lois Zitzmann, John Smerek, Roy Hesser, Nellie Williams), and collaborative director, Jerome Burke. Teacher Anita Madsen has served as the chair of the Council since the 1988-89 school year. During the school year, business representative William Carroll was joined by Jackie Richardson, also of CNA Insurance, who occasionally attended meetings in Mr. Carroll's place. In March and April, 1990, five middle school teachers became members of the Council--Cyrus Rodgers, Gerthia Carter, and Felton Mahr from Stowe Middle School, Laverne Dixon from Turner Middle School, and Marcine Hill from L'Ouverture Middle School. During the course of the year, 25 people were associated with the Council for at least some of the time. Paul Markovits, director of MSEC, attended the October and February meetings. Attendance at the ten meetings held during the year ranged from 12 to 18 with an average attendance of 14. All but one of the meetings were held on Wednesday afternoons, from approximately 3:00 to 5:00 p.m., at different locations in the area such as Harris-Stowe State College, the St. Louis Community College, the school district's curriculum and staff development office, and the American Red Cross building.

A large part of the Collaborative Council's meeting time during the year was spent on developing and revising the permanence proposal that was finally submitted to EDC and the Ford Foundation on April 1, 1990, and subsequently approved. At the July 18, September 20, and October 11 meetings, discussion of the proposal was prominent on the agenda. At subsequent meetings, the Council members were given updates on the status of the proposal and, following its approval, began discussion of how ideas in the proposal would be implemented. Other business conducted at the Council meetings included receiving committee reports and coordinating plans for future activities. At its March meeting, the Council approved funding for six people to attend the NCTM Annual Meeting in Salt Lake City.

The group voted in April to make the collaborative director's position full time since the money was available to do so. This took affect on July 1, 1990. Also at the April meeting, Cyrus Rodgers, a middle school teacher, was nominated and approved as one of two teachers to represent St. Louis at the Teacher Leadership Workshop to be held by EDC in New Hampshire. It was reported that the collaborative would contribute $600 to $800 to MATH COUNTS and that $62.50 would be allocated to each of five teachers for them to attend the Woodrow Wilson one-week summer institute. In May, Anita Madsen reported on her work on a proposal to St. Louis Public Schools to fund a part-time collaborative teacher chairperson. Reports were also received on committee activities and on future programs. Some discussion was devoted to a concern that the collaborative was duplicating what other organizations were doing. The collaborative director then shifted the focus of the group to thinking about future activities for teachers. The June 21, 1990 meeting was spent developing by-laws and revising the organization of the collaborative as projected in the permanence proposal.

### Permanence Proposal

In June and July, 1989, members of the Collaborative Council continued to work with Vice President Emeritus Dr. George Hyram from Harris Stowe College. Dr. Hyram was engaged by EDC in May, 1989, to help facilitate the process leading to permanence. Following a six-member meeting of the Council on June 28 that focused on developing plans for permanence, Dr. Hyram prepared a summary of that meeting for Steering Committee members, in time for members to read it before the July 18 meeting of the full Council. The summary identified the mission of the collaborative as that of providing professional assistance to metropolitan St. Louis mathematics teachers at the pre-higher education levels. The collaborative would be comprised of those who have an interest or stake in improved mathematics instruction and pupil learning at the secondary and middle school levels. The target population would be mathematics teachers working with under-achieving students in middle and secondary schools. The collaborative would be governed by a Board of Directors. The document also noted that the institutional affiliation and funding of the collaborative would have to be decided.

Members of the Collaborative Council discussed the draft and offered their comment to the small group drafting the proposal. This group met on August 28 and decided that Dr. Hyram should write the proposal and have it ready by the September 20 Council meeting. The Council was not satisfied with the 30-page proposal as presented in September and asked Director Jerome Burke and the teacher chair of the Council, Anita Madsen, to revise it. At the October 11 meeting, a number of Council members still found the tone of the proposal too negative, objecting to the fact that it enumerated weaknesses rather than focusing on strengths. Other issues brought up in the proposal that were deemed inappropriate by Council members included expansion of the collaborative to the larger metropolitan area (they felt this would stretch the collaborative too thin) and use of the term underachiever, rather than urban student, to describe the focus of the collaborative (a term they felt is too easily misconstrued). The draft of the proposal also left the form of governance undecided and recommended that the collaborative investigate some form of "shared governance" with the MSEC.

Anita Madsen, Gayle Coleman, and Jerome Burke were instructed to rewrite the proposal (1) to create a more positive tone, (2) to incorporate into the document provision for an expansion phase starting with outreach to business and higher education, as well as to urban school districts, and (3) to include the exploration of a "shared governance" arrangement. A revised proposal was hand-delivered to EDC staff at the UMC Annual Meeting in Los Angeles on October 19-21, 1989. This proposal was reviewed by EDC staff who gave suggestions for its improvement. Some were made. The proposal was resubmitted to EDC on November 10, 1989.

In November, 1989, Dr. Hyram withdrew because he felt he had done what he could for the process. In a letter of appreciation to Dr. Hyram, Mark Driscoll described some of the outcomes of his participation. Dr. Driscoll observed that even though Dr. Hyram had been engaged to facilitate the involvement of those from the larger community in the process of preparing the permanence proposal, his role had become more that of an evaluator identifying areas that could be improved. Major points from this evaluation were: "[The group] would be ill-served by continuing to draw their sustenance from internally focused conversations, with little action; . . . they should be a client-defined and not geography-defined group; and they should articulate carefully for the community at large what services they are prepared to provide for those clients." The evaluation came to be seen as a needed first step prior to bringing the larger community into the process. Dr. Hyram also was cited for supporting the group and raising the self-image of members with regard to the environment and opportunities of teachers in St. Louis County. Dr. Driscoll closed the letter by noting that a facilitator was still needed and that he would try to identify likely candidates.

The November 9, 1989 proposal describes the current organizational structure and the newly conceptualized structure. The membership of the collaborative as envisioned in the proposal would consist of all secondary and middle school mathematics teachers in the St. Louis Public Schools (approximately 200 teachers); representatives from businesses and firms in the Greater St. Louis area; representatives from the mathematics and mathematics education faculties of colleges and universities in the area: and preschool and elementary teachers of mathematics and interested parents. A Board of Directors comprised of 10 to 15 members would be elected by the general membership for terms of office that would be staggered. The initial Board would have 11 elected members--6 teachers, 2 business and industry representatives, 2 higher education representatives, and 1 school administration representative. Details pertaining to the administrative staff, appointed by the Board and charged with carrying out its policies, were not clearly specified in the proposal.

The collaborative's mission as stated in the proposal is to provide professional development opportunities and technical assistance first for teachers and then for parents. Seven major collaborative activities were projected in the proposal: making the conceptualized organization a reality; broadening the membership base; electing the Board of Directors at a convened conference; providing for the Board to establish its own structure; organizing the collaborative by appointing a chief administrative officer, creating by-laws, selecting an Advisory Council, and other planning activities; directing the chief administrative officer to staff and develop a program with the approval of the Board of Directors; and commissioning the staff to work in accordance with the by-laws and the collaborative's mission. Money for the collaborative would be raised through membership dues, corporate and philanthropic gifts, governmental grants, and the sale of instructional materials.

The teacher assistance activities include providing financial assistance to teachers that would enable them to attend professional meetings, conferences, and institutes; supporting speakers to make presentations on relevant topics; providing forums for professional interaction among collaborative members; informing teachers of the many opportunities available to them through MSEC and the Mathematics Educators of Greater St. Louis; assisting in planning district workshops; scheduling events at which teachers will give presentations; helping with the coordination of the Annual Mathematics Fair and Annual Mathematics Contest: and writing grants.

EDC responded to the proposal by letter on December 4, 1989. The members of the St. Louis Urban Mathematics Collaborative were congratulated for their work in developing the proposal. The EDC letter pointed out that while the proposal covered many important points regarding the organization and staffing of the collaborative, some items were missing or were not adequately covered. The EDC indicated that strategies needed to be developed to render the identified goals viable; there needed to be a greater expression of community support for the project; and there needed to be a clearer commitment from MSEC in helping to supplement the Ford Foundation's support. In addition, it felt that the role and duties of the program coordinators had to be specified as well, and more detailed examples and quantification of the collaborative's accomplishments provided. The collaborative was given until April 1, 1990, to respond to these concerns. If at this time the conditions for funding were met, Ford Foundation funding would be continued for six months, at which time a review to assess the implementation of the plan would be conducted. If adequate progress was being made, funding would be extended for another six months, until April 1, 1991. For any additional funding beyond this point, a continuation plan would have to be submitted to EDC by February 1, 1991, to begin the permanence phase of the collaborative on April 1, 1991, which may cover one, or two, years.

The proposal was resubmitted to EDC on March 4, 1990. The organization of the proposal was revised and more detail was provided regarding the development of the relationship between the collaborative and the business community, the St. Louis Public Schools, and the Mathematics and Science Education Center. More specific guidelines for the expansion of the collaborative through the 1991-1992 school year were presented. The 1989-90 goal was to include middle school mathematics teachers in the collaborative and establish more contacts with businesses. The program in 1990-1991 is oriented to the development of more programs for preservice and novice teachers and the expansion of resources available to mathematics teachers in the district. In 1991-1992, the collaborative is projected to assist in developing new curriculum and programs for students in the new magnet schools and to expand to include teachers from selected districts in the county. The programs that would be provided by the collaborative were essentially the same as those listed in the previous proposal. More attention was given to involving collaborative teachers in curriculum development by documenting experiences they had had through the collaborative which made them more cognizant of curriculum needs. Also, the point was made that the SLPS Partnership Program was one means of developing ties with business and industry and that collaborative teachers have been participating in this program through their schools.

The March 1990 proposal notes a possible link with the St. Louis Regional Science and Technology Career Access Center (RCAC), funded by the National Science Foundation and situated in four institutions of higher education and the school district. RCAC seeks to increase the number of students from underrepresented groups who enter mathematics, science, or technology careers. The collaborative is proposing to oversee the expansion of programs such as MATH COUNTS and JETS, a science, mathematics, and technology student club activity of the Junior Engineering and Technical Society, that are both emphasized by RCAC. Areas needing improvement outlined in the proposal were those cited in previous proposals and included organizational structure, outreach, extension of goals, and expansion of funding sources. Supporting letters attached to the proposal were signed by Dr. James E. Westbury, president of the Board of Directors of the Mathematics and Science Education Center; William Carroll, CNA Insurance Companies; and William A. Pearson, associate superintendent for Curriculum and Programs, St. Louis Public Schools.

Mark Driscoll sent a letter to Jerome Burke on March 29 raising concerns that the EDC still had regarding the proposal. These concerns centered on support for the collaborative and its programs. The proposal had failed to convey to the EDC the strong support the collaborative had from MSEC, St. Louis Public Schools, or the broader St. Louis community. These organizations had not satisfied the EDC that they would do what is necessary to make the collaborative succeed. The program areas for the collaborative needed to be defined more concretely. Mr. Burke was asked to respond to three points: How can EDC and UMC/STL work together between the checkpoints to make the permanence of the collaborative more likely? What was the rationale of the Council for assuming that formal and legal ties will be maintained with MSEC? and How consistent are the program suggestions in Dr. Driscoll's letter with those of the collaborative?

On April 5, Jerome Burke responded to these questions in a letter sent to Mark Driscoll. This letter reported that there were sufficient funds to increase the director's position to full time, beginning July 1, 1990. Neither the collaborative nor MSEC was assuming that the existing relationship has to continue, but under the current circumstances it is the preferred option. The letter noted that a consortium of five area-wide educational support agencies was being formed in St. Louis--MSEC, the Network for Educational Development, the Regional Consortium for Educational Technology, the Principal's Academy, and the International Educational Consortium. When this consortium becomes a reality, it might provide more stable financial support for the collaborative. Until that time it would be unwise for the collaborative to finalize its financial plans. The interaction of collaborative teachers with the district's mathematics supervisor in curriculum reform was reemphasized. This activity will be increased. Winifred Deavens, mathematics curriculum supervisor, outlined five areas in which collaborative teachers would be involved in helping her: to serve as teacher-trainers in school-based inservices and districtwide staff development activities to move the curriculum toward alignment with the NCTM *Curriculum and Evaluation Standards*; to present workshops and consult with both mentor and novice teachers to further curriculum reform; to serve on task forces and advisory committees to pilot new textbooks; to participate in a field test of the *Transition Mathematics* materials for grades 7 and 8 from the University of Chicago School Mathematics Project; and to present workshops to coach other teachers in the use of calculators for concept development and for mathematics applications. No specific suggestions were given on how EDC and UMC/STL might work together between the six-month checkpoints.

The proposal and the letter that responded to questions asked were sufficient to meet EDC's concerns. On April 10, 1990, EDC sent a letter to Barbara Scott Nelson at the Ford Foundation recommending the approval of the proposals under the conditions specified in the December 4, 1989 letter. On May 9, 1990, Dr. Burke received a telephone call from Dr. Nelson to tell him that the proposal had been approved by the Ford Foundation for six months, at the end of which a judgment would be made by the EDC as to whether there was sufficient progress to continue the funding for the remaining six months. On receiving word of the proposal's approval, Drs. Markovits and Burke drafted a position description for a full-time collaborative director that was then discussed and approved at the May Council meeting.

### Outreach Action Grant

On February 1, 1990, the St. Louis Urban Mathematics Collaborative submitted a proposal to the Outreach Project of EDC in response to its request for proposals. The SLUMC proposal listed two main goals. The first was to further curriculum reform by forming a network of teacher-trainers and by helping to reshape the district's curriculum. The second was to assist in implementing staff development programs by developing a college course, preservice and inservice workshops, and preparing a resource book focusing on the NCTM *Curriculum and Evaluation Standards*. Although the proposal was not funded, the collaborative was promised a grant of $1,000 towards the project if the remaining funding could be raised from other sources.

## D. Project Activities

During the 1989-90 school year, the St. Louis Mathematics Collaborative sponsored a wide variety of activities for secondary and middle school mathematics and computer teachers in the St. Louis Public Schools. The collaborative also promoted teacher participation in a variety of activities that were sponsored by other organizations, but were related to fulfilling collaborative goals, and it provided financial assistance for teachers to attend local, regional and national conferences.

### Local Seminars, Symposiums, and Inservices

#### Computer Seminar Series

The collaborative sponsored a seminar series, "Computer and Your Curriculum," August 2, 4, 8, 10, 1989, from 1:00 to 3:30 p.m. daily. The series, which was held at

O'Fallon High School, was taught by two collaborative members, with each instructor teaching two of the sessions. The seminar was designed to assist teachers in implementing the new mathematics curriculum, which incorporates the use of computers and software that had been purchased along with the new textbooks.

The workshop, which did not require an enrollment fee, was open to all teachers in the district, but only five or six people participated each day--three or four teachers, the collaborative director, and the collaborative teacher chairperson. In spite of the poor attendance, all four seminars were offered. It appears that the teachers who did attend felt that the seminar series was worthwhile. One teacher remarked, "The workshop was good . . . .Too bad that very few people showed up. Maybe we could have it again during the school year. Some people may have been turned away. I was told at first there was no workshop. They were working on the building removing asbestos."

## Dinner Symposium

On May 29, 1990, the St. Louis Collaborative sponsored a dinner symposium, "Problem Solving in the Curriculum, Correlated to 'Someone told me the answer'--Are our Students REALLY Afraid to Think?" The lecture on problem solving, which began at 4 p.m., was presented by Dr. Larry Campbell, a professor on sabbatical from the School of the Ozarks, and president-elect of the Missouri Council of Mathematics Teachers. Following Dr. Campbell's presentation, the collaborative hosted a complimentary dinner. Attendance at the dinner was to be limited to the first 35 people to make a reservation, but due to the favorable response, reservations were extended to include 50 people. During the dinner, the collaborative presented the "Teacher of the Year Award" to Lois Zitzman and also recognized several outstanding members of the collaborative. The Teacher of the Year selection was based on the results of ballots that had been distributed previously.

Although reservations to the dinner were limited to members of the collaborative, all area mathematics educators were invited to the symposium, which was held at the Cheshire Inn. The event, seen as an opportunity for mathematics educators to network professionally and to stay motivated and abreast of the latest in mathematics, was well attended and appreciated by the teachers. One teacher said, "The dinner was good. I was glad to see Lois was Teacher of the Year. She has worked very hard at school and with the collaborative. She was an excellent choice. I was a little disappointed in the speaker. I had seen him before in a workshop setting and he was excellent. This time he talked too much without giving any of his excellent examples." A second teacher remarked, "Nice man with excellent ideas. These are the things I feel I always do in the classroom. A good session put together at the last minute. I am glad we had it." A third teacher commented, "Nice turnout this late in the school year. The collaborative needs to plan and do more next year. We need to stay in the limelight. So many teachers do not know that we do much of anything. At least three of these types of sessions a year." A fourth teacher concluded, "I have just become active in the collaborative. This is a very good organization. I think I will be more active next year. I plan to come to the organizational meeting in June. I hope we can become better organized and funded for next year. This session was very good. I enjoyed it."

## Inservice Program

The St. Louis Collaborative, in cooperation with the Mathematics Curriculum Department of the St. Louis Public Schools, sponsored Title II inservice programs for St. Louis middle school and secondary school mathematics teachers on January 22, 1990. The program for the secondary teachers was held in the morning, while the middle school inservice program was held in the afternoon. Approximately 100 secondary teachers and nearly 65 middle school teachers attended the inservice held at Carpenters Hall. Twenty representatives from business and industry, as well as three from higher education, also participated in the day's events.

The Secondary Mathematics Inservice Program began at 7:30 a.m., with a continental breakfast. Following a welcome and program overview by Mathematics Curriculum Supervisor Winifred Deavens and announcements by Collaborative Director Jerome Burke, the teachers attended one of three sessions: "Integrating Problem Solving into the Teaching of Algebra and Geometry," by Dr. Katherine Pedersen, Southern Illinois University at Carbondale, compliments of the Addison-Wesley Publishing Company; "Activities and Applications Using the Scientific Calculator Casio Model fx-115," by Dr. Bennie A. Adams, professor at the University of Missouri-St. Louis; and "An Introduction to the Graphing Calculator Casio Model fx-7000G," by Mr. Richard Armstrong, professor at St. Louis Community College at Florissant Valley. Following a break, the three sessions were repeated a second time between 10:15 and 11:40 a.m. Teachers had the opportunity to visit several booths displaying interactive exhibits including those demonstrating software. A complimentary lunch was served from 11:45 to 12:15, during which additional announcements were made on the upcoming Mathematics Contest, the Mathematics Fair, and Title II Program.

The Middle School Mathematics Inservice began with a complimentary lunch, followed by a welcome and program overview by Supervisor Deavens and announcements regarding Title II, the Mathematics Collaborative, and Scott Foresman's participation. Teachers then selected one workshop session from three being offered: "Enhancing MMAT Skills through Problem-Solving Activities," by Dr. Helene Sherman, assistant professor at the University of Missouri-St. Louis; "Developing Test-Taking Skills through Problem Solving and Critical Thinking," by Dr. David Williams, consultant with Scott Foresman Publishing Company; and "Activities for Implementing New Curriculum and Evaluation Standards," by Jane Martin, mathematics consultant. Following a break, the topics were repeated a second time between 1:55 and 2:55 p.m. The program concluded with a brief evaluation.

The on-site observer reported that the inservice program was very successful. He felt that the teachers got more out of this inservice than others. It was noted that before the collaborative was formed, inservices were typically at schools and continental breakfasts and lunches were not served. The collaborative was credited with being a factor in the improved atmosphere for inservice meetings.

A teacher who attended the Secondary Mathematics Inservice Program commented, "This was one of the few inservices I enjoyed. I enjoyed the graphing calculator and would like to purchase one. I picked up information I could use in all math classes. I think the graphing calculator may be easier to use than the computer. As soon as we get a set, I plan to start using them." Another teacher said, "I enjoyed the demonstration of the Casio graphing calculator--excellent hands-on experience with the calculator." A third teacher remarked, "The calculator workshop was very beneficial and rewarding. I have not learned all the buttons on my calculator. More time was needed for the calculator workshop. All secondary teachers need the training on the calculator." A fourth teacher stated, "This [inservice] was better than the others--I still would rather be in my classroom. I did enjoy the calculator workshop. I can't see much of a use for such a complicated calculator in my lower level classes--I can see many uses in upper division classes. I am not sure if it [the inservice] will affect my teaching. I may try a problem or two I saw."

## Interaction Sessions

During the 1989-90 school year, the collaborative sponsored two sharing/professional interaction sessions for secondary and middle school mathematics teachers and district administrators to provide them an opportunity to meet and network outside the work setting.

### Welcome to the New School Year Picnic

On Thursday, September 21, the collaborative sponsored a "Welcome to the New School Year" picnic at Tower Grove Park for all St. Louis secondary and middle school mathematics teachers as well as for district administrators. The flyer publicizing the afternoon picnic described it as "Food for the mind, food for the body, a complete rest for the pocket (i.e., no charge)."

The picnic, which was planned by Bill Stadtlander, a mathematics teacher at Roosevelt High School, provided an opportunity for teachers who had received collaborative funding to attend professional activities during the summer to share their experiences, as well as to provide a setting for informal interaction.

Approximately 30 teachers and the Collaborative Director Jim Burke and Council Chair Anita Madsen attended the picnic. Everyone seemed to have a good time and to appreciate the opportunity to get together with their colleagues in an informal setting. One teacher remarked, "I like these types of activities. I feel free to talk and socialize. I learn a lot by talking to my colleagues. I like this location. The picnic idea was a good one. I am willing to try most anything that will improve my ability to teach. The students seem to do so badly no matter what I try." A second teacher said, "This is just what we need to start the school year out. A little fun along with work. I enjoy talking informally with teachers from my school and others. I don't have much time on the job to talk. Good ideas come out of these meetings." A third teacher commented, "I always enjoy getting together and talking with other teachers. I was glad to see a few middle school teachers. I hope we can talk more of them into attending the next function. It would be good if middle and high school teachers could talk more." A fourth teacher added, "This keeps down teacher 'burnout'. Good for morale." The on-site observer reported, "This brings out teachers who do not come to other events. I saw three or four teachers there that I had not seen before. There were several middle school teachers. It was a very good day for a picnic. Everybody who attends these informal get-togethers always enjoys them. I believe they are good for morale."

## Spring Informal Professional Interaction Group

The collaborative sponsored a dinner meeting for the Informal Professional Interaction Group on March 23, 1990, from 2:30 to 6 p.m. at Garavelli's Restaurant. The flyer that publicized the meeting, which was sent to each middle school mathematics teacher and to secondary department heads for distribution to the mathematics teachers, announced an agenda that included refreshments, camaraderie, and conversations about teaching and about mathematics. Each of the 43 teachers who attended received a copy of the working draft of the NCTM's *Professional Standards for Teaching Mathematics*, as well as other professional literature. The collaborative director and teacher chairperson as well as the district mathematics supervisor also attended the event.

The event was very successful. The teachers were grateful for the chance to socialize. One teacher remarked, "I was glad I stopped by. It is always good to get together and talk. You meet teachers from all over the system. We all have the same problems. It is good to be able to discuss them with teachers from other schools. Makes you feel good." Another teacher said, "I met several middle school teachers. I was glad to see that they are joining in with us. I feel the more we know about how each other thinks the better we will do in educating our children." A third teacher commented, "Good to get together and talk about mathematics. Some of us never see each other except at events like this. Some teachers never come to other events; at least we get them out for something. Just getting these teachers to talk with teachers that are active helps them to improve. Maybe they will take some new ideas back in the classroom." A fourth teacher added, "Nothing better than a good social after working all week. It would be nice if we had one every week. I always hear some good ideas to use in the classroom from these sessions. I know more teachers in the system now. We need nametags." A fifth teacher said, "I'm a middle school teacher. This is my first time at a collaborative activity. I plan to get more involved. I will be at the next meeting. I also plan to go to Salt Lake. That will be my first national convention." The on-site observer concluded, "Very good turnout. I was glad to see middle school teachers."

## Fairs and Contests

### Veiled Prophet Fair

The collaborative participated in the community-wide 1989 Veiled Prophet Fair, a popular Fourth of July celebration which is held on the grounds of the Arch near the riverfront. The collaborative sponsored a booth on Education Day, July 3, 1989, in a section reserved by the Mathematics and Science Education Center. Visitors to the collaborative booth could play mathematics games and pick up pamphlets about games and computer activities, as well as a collaborative brochure. The booth, which was visited by hundreds of people, was very popular. The collaborative members who worked at the booth reported that it was very successful.

### Mathematics Fair

The third annual Mathematics Fair, co-sponsored by the collaborative and the St. Louis Public Schools with financial support from corporate sponsor General American Life Insurance Company, was held March 12-14, 1990, at the Naval Jr. ROTC Academy. The fair was originally initiated in order to foster creativity, problem-solving skills, and a general interest in mathematics among high school students. In response to a proposal from the collaborative's Mathematics Fair Committee, General American Life Insurance Company, which has its headquarters in St. Louis, agreed to be the corporate sponsor for the fair and granted the committee $12,000 to cover expenses and awards for the fair.

All St. Louis public high school students were invited to participate and over 200 individual projects were entered, as compared with the 148 projects on display at the 1989

Fair, and the 88 projects at the 1988 Fair. Each project was entered in one of three categories: Exposition, Investigation, or Computer Programs. A number of elementary, middle, and high school students visited the fair to see the projects on display. The fair also attracted a large audience of teachers, school administrators, and representatives from business and industry. The St. Louis Public Schools provided release time to enable teachers to attend the fair. Thirteen collaborative teachers comprised the Mathematics Fair Committee. The 29 project judges and 19 computer judges included teachers and school administrators as well as representatives from business, industry and the local NCTM affiliate. The collaborative's on-site observer was the judging coordinator for the fair.

On March 14, the last day of the fair, an awards ceremony was held. A welcome was extended by Ivory Lofton, the principal of the Naval Jr. ROTC Academy, with greetings by Benjamin Price, executive director of Curriculum and Staff Development. The guest speaker was Charles L. Larance, General American Life Insurance Company; Dr. Julius Dix, assistant superintendent of the St. Louis Secondary Schools, made the closing remarks. Thirty-seven high school students received awards. In addition to cash awards (which ranged from $50 to $650), each winner received a trophy, ribbon, and certificate. Many of the awardees also received a calculator or computer software. Eighth-grade students were encouraged to attend the exhibits and awards ceremony to motivate them to participate in the future.

The on-site observer reported that the fair was extremely successful--that it is becoming more impressive each year. People were especially pleased with the quality of the projects that were entered. After completing the judging process, several of the judges requested the names of students, whose entries they found so impressive that they were considering offering them internship positions at General America. One teacher said, "I am very proud of our students. This shows what they can do if they try. I hope next year all schools will take part. We may have to start prejudging the entries." A second teacher remarked, "Well-organized, well-run, very good for all our students--middle and high school. I was glad my students were able to see the exhibits." A third teacher commented, "This was by far the best fair we have sponsored. The projects were much better than last year. It was very well run. The judges seem to be much better. It was very nice of General American to sponsor this event. The prizes are just great. This should encourage more participation." A fourth teacher added, "Much better than last year. Maybe some of the projects should be prejudged at the schools. I think now we should strive for excellence rather than quantity." A fifth teacher added, "Very well organized again this year. This is the best idea to come out of the collaborative. The committee must have worked very strenuously. I am proud of the St. Louis schools." A retired department head from St. Louis University who had served as a judge commented, "Some of the projects showed a lot of originality. I wonder if some of the students know how good they really are. Good work. I was glad to be a judge."

## Secondary Mathematics Contest

The Third Annual St. Louis Public Schools Secondary Mathematics Contest was held from 8 a.m. to 1 p.m. on April 28, 1990, at Southwest High School. The contest, which was cosponsored by the collaborative and six area businesses, was initiated both to provide a vehicle for competition between the area high schools and to improve students' test-taking skills and SAT scores. The nine-member teacher committee that planned the contest received a release day from the district so that they could meet. Each St. Louis high school was invited to enter eight students, two per grade level, to compete for team, school, and division awards. In total 112 students representing 14 high schools participated.

The event began with registration from 8:00 to 8:45 a.m. The testing session ran from 9:00 to 10:30 a.m., followed by a luncheon for all participants. After lunch, the Awards Ceremony was held. Mathematics Supervisor Winifred Deavens served as Mistress of Ceremonies, and Patricia Wharton, a corporate attorney with Ralston Purina, was the guest speaker. The awards were presented by William Carroll, manager of Group Sales for CNA Insurance Company, and David Lossos, marketing representative for IBM. Again, Dr. Dix, assistant superintendent of Secondary Schools, made the closing remarks.

Although some teachers expressed concern about the difficulty of the test and the emphasis of the test items, which had been created by a teacher committee over the past year, overall teachers seemed to feel that the contest was a beneficial experience for their students. One teacher said, "A big success again this year. The students had a good time. I wish more students could take part. Some schools have many more than two or three good students. Many of the regular schools have a difficult time competing with Math and

Science, the Senior Classic Academy at Soldan High School, and the college preparatory program at Metro High School. It is good experience anyway. I am looking forward to next year." A second teacher remarked, "Good. I have less complaints this year than last year. The test was still far too difficult for most students. My students worked as hard, but did not win. We will never win unless they divide into divisions. The test contained more logic this year. It was not so subject-oriented as last year. I liked that, but so hard." A third teacher noted, "Difficult test, but a fair test. I feel the better students won. This is the way it is in life. All schools tried, Soldan is just the best. One of the best ideas to come out of the Math Collaborative." A fourth teacher remarked, "Problem solving means different things to different people. What is a problem? I thought the test could have been aimed more towards the textbook material with less new critical thinking problems. Somewhere between last year's and this year's. The committee deserves much thanks for taking on such a laborious job. I look for the contest to become better and better." William Carroll, a representative of CNA, which in the last three years has donated nearly $6,500 to support the Secondary Mathematics Contest, commented that he was very pleased with the event and is looking forward to next year's contest.

## MATH COUNTS

The collaborative contributed $600 to fund the St. Louis Public Schools' MATH COUNTS competition, which was held from 8:30 a.m. to 12:30 p.m. on Saturday, May 19, at the Engineer's Club. Approximately 100 middle school students, representing 8 schools, participated in the local competition, which also received support from the Urban League, Southwestern Bell, Monsanto, and the Missouri Society of Professional Engineers. Collaborative teachers were encouraged to attend the event and to volunteer their assistance.

The areawide MATH COUNTS competition had been held on February 24, 1990; only five St. Louis Public Schools had participated. Next year, the schedule will be arranged so that the St. Louis Public Schools competition is held before the areawide competition.

## Summer Internship Program

The McDonnell Douglas Corporation and the Mathematics and Science Education Center cosponsored a 1990 summer internship program for grades 7-12 science, mathematics, and computer science teachers. The program, "Technology in Context: Generating Curriculum From Internships," is designed to help teachers use a summer internship experience to develop and implement technology-based curriculum. Interns will participate in an eight-week internship at McDonnell Douglas, between June 18 and August 10, 1990; participate in curriculum workshops on June 14 and 15; and attend curriculum seminars one morning a week during the internship. During the school year, the participants will implement and revise the curriculum project and attend a curriculum workshop. Interns will receive a $4,500 stipend for their project activity during the June to December period.

On January 18, 1990, McDonnell Douglas Corporation and the Mathematics and Science Education Center sponsored a reception to present the curriculum projects that had been developed by the three teachers who had participated in the 1989 summer internship program. The teachers were compensated for their seven-week internships at a salary of $500 per week. All St. Louis area mathematics and science teachers were invited to the reception, which was held at the Headquarters Building of the McDonnell Douglas Corporation. At the January reception, applications for the expanded 1990 internship program were distributed.

The collaborative publicized the reception and encouraged teachers to apply for the 1990 internship program. Four collaborative teachers applied for the 11 positions that were available, and one collaborative teacher was accepted.

## Local, State, Regional, and National Conferences and Institutes

As part of its effort to promote the professional development of teachers, the collaborative provided financial assistance to support teachers' attendance at a variety of local, state, regional, and national conferences.

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: 1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; 2) to help teachers develop a strategy for local change tied to an issue which is critical to the growth of their collaborative; 3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and 4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for effective school leadership: understanding and communicating with people in organizational settings and exercising organizational leadership.

Three collaborative teachers, including collaborative teacher chairperson Anita Madsen, attended the Teacher Leadership Workshop. EDC had agreed to sponsor two teachers from each collaborative, paying for room, board, registration, and transportation. The collaborative paid for the third teacher to attend. The three teachers were selected by the collaborative director and teacher chairperson, based on written applications submitted in the spring. One teacher who attended said that the Leadership Workshop was one of the best conferences she had attended. Another participant commented that she particularly valued working with the Myers-Briggs Type Indicators as it gave her insight in working with individual differences.

## University of Chicago School Mathematics Project Conference

The collaborative paid approximately $1,400 in travel expenses for Mathematics Supervisors Winifred Deavens and Jeanie Wells and Masen Investigative Learning Center administrative assistant Andrea Walker to attend a workshop in Chicago, August 7-8, 1989, on using the *Transition Mathematics* and *Algebra* materials. The programs, which were developed by the University of Chicago School Mathematics Project and published by Scott Foresman, were piloted at Turner and Mason Magnet Middle Schools during the 1989-90 school year. The three collaborative representatives who attended the workshop will form the nucleus of the teacher training corps to facilitate the training of other district teachers.

## State of the Art Presentation Skills

The St. Louis Collaborative sponsored three collaborative teachers to attend the professional development program, "State of the Art Presentation Skills." The two-day workshop was held October 12-24, 1989, from 8:30 a.m. to 3:00 p.m. The program was offered by the Network for Educational Development, a consortium of cooperating school districts in the St. Louis area. The collaborative paid the $125 registration fee for each teacher, and the St. Louis Board of Education released the teachers from school and provided substitute teachers.

The program was presented by three members of the Network Cadre, with Bob Garmston making the first day's presentation and Diane Scollay and Georgia Archibald presenting the program on the second day. The program centered on the importance of style in presenting information. The first day was designed to provide theory and examples to show participants how to assess their own skills and develop a repertoire of strategies. The second day provided participants with hands-on opportunity to practice their presentation skills and to define and refine their own presentation styles. The topics addressed in the program included: chunking content for maximum effect, using stories and metaphors effectively, creating rapport with the audience, establishing credibility, and increasing the energy and involvement of the audience.

The teachers who participated found the program very beneficial. One teacher commented, "Very informative! Really great! The presenters were great. I felt like going back in the classroom and just 'doing it'. Not only were there good ideas that could be used with adults, but also ideas you use in the classroom. It was a well organized workshop that would make any teacher improve." A second teacher said, "Very worthwhile. Money well spent. The presenters were well organized and had really good styles. I now feel that I have excellent ideas to get my content over both in the classroom and as a presenter. This workshop will help me think about what I say and will make me a better teacher."

## The Missouri Council of Teachers of Mathematics (MCTM) 1989 Fall Conference

On December 1 and 2, 1989, the MCTM held its 1989 Fall Conference at the Holiday Inn in Columbia, Missouri. Approximately 800 teachers from around the state attended the two-day event, which addressed the topic, "The Standards Are Here . . . What Now?" The teachers were able to choose from among 50 sessions and 11 workshops. The two luncheon speakers, both textbook authors, were Dr. Philip Halloran of the Springfield, Massachusetts, Public Schools and Professor Emeritus Dr. Phares O'Daffer from Illinois State University. In addition to the conference sessions, the participants had the opportunity to view exhibits of mathematics texts and supplemental materials.

While the collaborative had volunteered to reimburse up to 20 secondary and middle school teachers $50 each to help offset expenses, only eight collaborative teachers applied for funds. Seven of the eight teachers were eligible to receive funding for participating in the conference program, two as speakers and five as presiders. Only one or two people actually received collaborative funding because most teachers who attended received Title II monies. All of the teachers felt that the conference was very worthwhile. One teacher commented, "This was the best state convention we have had in Missouri. The sessions I attended were excellent. I always enjoy the problem-solving sessions. The three sessions I attended were all very educational. I picked up a large number of problems that I plan to use with my class." A second teacher remarked, "Very good convention. I really enjoyed the session on math projects. I was looking for ideas to help me with this year's Math Fair and Math Contest. I gathered several ideas and suggestions for this year's fair. I was glad to see we are increasing the number of presiders and speakers from the collaborative." A third teacher added, "The calculator workshops were excellent. I attended two; one on the Casio fx-7000G and one on the regular scientific calculator. I plan to use the calculator more. I hope we can get a room set of graphing calculators very soon. The middle grade manipulatives session was very good. I gained valuable knowledge I could use at the GEM and pre-Algebra levels." A fourth teacher noted, "This year's selection of 'sessions' and 'workshops' was excellent. Usually there are one or two good ones . . . but all of the ones I attended were very educational. The speakers were all good. In talking with other participants, they all agreed this was by far our best conference." The on-site observer reported, "This was the best of the state meetings. St. Louis had more participants than ever before."

## Training for Partnerships

The collaborative funded three teachers and collaborative Director Jerome Burke to attend a weekend training program for teachers sponsored by the National Association of Partners in Education (NAPE). The conference was held February 24-25, in Dallas, Texas. In addition to the four participants funded by the collaborative, Wayne Walker, the director of the Partnership Program for the St. Louis Public Schools presented. The focus of the conference was to train teachers to develop partnerships with business and to strengthen partnerships that are already established at their schools.

Although the teachers felt that the sessions were long and that there was little time for relaxation, they reported that the conference was very helpful and they left with concrete steps to follow. One teacher said, "I feel like I am ready to start a partnership now. The networking was just great. The sessions were long, but it was excellent. We discussed a most beneficial 12-step program for setting up a partnership." A second teacher commented, "It was a good conference. The speakers were good. There were many good ideas passed around. . . .I was so tired, they should have had more time for relaxation. A third teacher added, "The networking was especially beneficial. The lady in charge was very good. I was able to talk with people from all over the world. Many strategies were discussed. There are many ways to set up partnerships. I feel much better qualified than before."

As a result of the conference, the collaborative established two goals: to encourage people to make better use of partnerships in their schools; and to specifically develop partnerships with the collaborative. While the conference attendees continued to work with partnerships through their schools, no new partnerships had evolved through the collaborative by the end of the reporting period.

## Interface '90 Conference

The Missouri Department of Elementary and Secondary Education, in cooperation with the Missouri Education Center, sponsored the Interface '90 Conference at Marriott's Tan-Tar-A Resort February 25-27, 1990. The conference, which is open to all state mathematics and science teachers, offers over 214 sessions with topics ranging from

"Champagne Math on a Beer Budget (Cheap, Readily Available Math Manipulatives)" to "Using A Spreadsheet in Beginning Algebra" and "Stress and the Teacher--Listen and Learn to Manage Stress." In addition, each day there were featured guest speakers at the general sessions. Displays of Incentive Grant Projects and "hands-on" high technology, as well as a mobile science museum, were set up. The collaborative encouraged members to attend the conference and seventeen teachers participated. The SLPS Title II program paid for the hotel rooms, registration fee, and meals for 16 teachers and the collaborative paid these expenses for one teacher. The Board of Education provided funding for substitute coverage on Monday and Tuesday.

The conference was extremely well attended, resulting in many of the sessions being overcrowded. In spite of this, the collaborative teachers seemed to enjoy the conference and felt that they learned a great deal. One teacher said, "This was the biggest conference we have had so far. If it continues to grow it will have to be moved. This will defeat the purpose. . . .The sessions were too crowded. The rooms are too small. People stayed in the room from one session to the other and new people could not get in. I did pick up several new ideas I could use in my classroom." A second teacher commented, "This is a good chance to show off local talent. I could see what many of my colleagues throughout Missouri are doing in the classroom. I plan to use several ideas, especially some of the manipulative tricks I saw. I also found some good problems I can use in Algebra and Geometry. I am looking forward to going again next year." A third teacher remarked, "I enjoyed the session on math clubs. I plan to try and start one next year. We would do much better in contests if we had a club. I also picked up ideas on writing grants. I am going to write until I get one for something." A fourth teacher added, "Good. I have started going now. I plan to travel to as many conferences as possible. They are more exciting when you are away from St. Louis. It was beautiful on the lake. Several of the sessions were good. I like 'Family Math'. This is a very good approach." A fifth teacher noted, "So many, many topics. The sessions were overcrowded. People stayed from one session to the other. New people could not get in. They need more space. I hate to see them move the conference. Tan-Tar-A is such a lovely place." The teacher whose expenses were paid by the collaborative felt that the offerings for mathematics teachers were very slim considering the number of those who attended.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Sixteen collaborative members, including 14 teachers, the collaborative director and Council chair, as well as a present school administrator and 2 former school administrators, attended the 68th Annual Meeting of the NCTM in Salt Lake City, Utah, April 18-21, 1990. Title II funds were used to fund 13 of the participants. The collaborative provided funding to cover transportation and lodging for six members of the Collaborative Council who wanted to attend but did not receive Title II funding. Substitute teachers were not needed, since the convention occurred during spring break.

The theme of the conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened to seek new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

The teachers seemed pleased to have had the opportunity to attend the conference. One teacher remarked, "I tried to attend as many sessions as possible dealing with problem solving. I attended several very good sessions. I added to my collection of problems. I thought the conference was good. I did not send my reservation in as quick as I should. Most of the workshops were filled." A second teacher said, "I spent a lot of time looking at the displays. I wanted to see what was out there that was new. There seem to be some wonderful things in the offing. Calculators are improving. Some of the new ones will do most everything. There is also a lot of good software on the market. Teaching could really become exciting in the next few years." A third teacher commented, "The best session I attended was a comparison of Japanese schools with American schools. The schools are very similar. They work much harder, getting tutoring on Saturday and after school. I am convinced that they are not better in ability, but just spend much more time studying." A fourth teacher noted, "I tried to do so much I was exhausted. I tried to make as many meetings as possible. Between all the convention meetings and trying to attend EDC meetings, also the Benjamin Banneker [Association] sessions, I was beat. The convention was good and I attended some very good sessions. The new computer software and calculators are marvelous. I really like the new Texas Instrument graphing calculator." A fifth teacher added, "Many choices. I picked some good ones and I picked some bad ones. The convention is becoming bigger and bigger. I really enjoyed it." The on-site observer concluded, "I always learn from the NCTM convention. I plan to attend next year."

## Making Mathematics Work for Minorities National Convocation

The Mathematical Sciences Education Board sponsored a national convocation, "Making Mathematics Work for Minorities," at the Ramada Renaissance Techworld in Washington, D.C., May 3-4, 1990. The National Convocation was the culmination of a year of activities designed to increase participation by members of underrepresented groups in the mathematical sciences. During the several months preceding the conference, six regional workshops were held during which concerned Americans identified educational programs that work for diverse ethnic populations, delineated factors which influence achievement by students from underrepresented groups, and reached a consensus on directions for change. The St. Louis collaborative had sponsored the participation of Winifred Deavens and Jerome Burke in the regional conference that was held in Chicago, November 3-4, 1989. The national meeting built on the regional workshops, producing a national action plan and launching Project AIM, the Alliance to Improve Mathematics for Minorities. The convocation is an invitational meeting for representatives from all regions of the nation. The meeting addressed the concerns of educators, legislators, parents, business, industry, funding agencies, students, and national, state, and community organizations.

The Making Mathematics Work for Minorities Project of the Mathematical Sciences Education Board is a decade-long program designed to reverse long-standing patterns of underachievement and underrepresentation of students of diverse ethnic populations in mathematics. Its goals are to: focus national attention on the task of having more students from underrepresented groups succeed in mathematics; increase participation in mathematics by students of diverse ethnic populations; and develop a national action plan and a national alliance of organizations committed to improving the achievement of students from underrepresented groups in mathematics. The project is supported by a grant from the Exxon Education Foundation. Additional support for the regional workshops was provided by a grant from the Historically Black College Council of the Office of Naval Research and the University of the District of Columbia.

The St. Louis collaborative sponsored the attendance of four teachers: Donald Bright, Lois Zitzmann, Nellie Williams, and Cheryl Ward. Originally eight teachers had expressed interest in attending the conference, but due to the cost of the conference, only four teachers could be funded to attend. The final four participants were selected from among those teachers who continued to express interest in attending. Each collaborative teacher received approximately $520 in funding to cover transportation, registration, and lodging. Substitute teachers for the two classroom days that were missed were provided by the SLPS district.

The teachers who attended the National Convocation seemed to find it very informative. One teacher said, "The conference emphasized inclusions rather than exclusion. A student should be allowed to work his way out of a class rather than into a class. Better interaction between colleges and high school math. A very good conference. I heard several specific ideas I will try." A second teacher remarked, "A good conference. The speakers related many of their experiences in helping students of diverse ethnic populations improve in math. Networking between high school, college, and business seems to be a big key. What colleges have programs to help students of underrepresented groups is also very important when choosing a college. Building self-esteem with help from forward-thinking administrators and teachers. We have [had] almost ten years to do it. They gave out lots of statistics. Very little interaction between speakers and participants." A third teacher added, "Some of the schools that had tried the experimental programs with minorities were very impressed by the number who go on to college. Black colleges seem to be the best for some minorities. They seem to work more in groups and get better attention. Many have gone on to graduate school and are now working in math-related fields in industry doing very well." As an outcome of this conference, a retreat, Making Mathematics Work for Minorities, a Local Response to a National Issue, will be held in May, 1991, funded with Title II funds. Approximately 50 teachers and others are expected to participate in the retreat.

## E. Observations

### Project Management

The management of the St. Louis Urban Mathematics Collaborative became more stable during the 1989-90 school year. The half-time collaborative director, employed by the MSEC in the position of mathematics coordinator, and the Collaborative Council made the decisions for the collaborative. The transition at the beginning of the year from Helene Sherman as director to Jerome Burke had gone smoothly, mainly because of Mr. Burke's work with the collaborative in the previous years. In a sense, his work at the Center was a continuation of what he had been doing as a mathematics supervisor for the district. Because of the effort that had to be devoted to developing a permanence proposal, the major problem during the year was finding time to plan and generate new programs and to increase the number of people participating. The two teacher coordinators who were appointed in February, 1990, assisted the director by facilitating communication with teachers. Cyrus Rodgers, the middle school coordinator, specifically worked to recruit middle school teachers.

The St. Louis collaborative has been operating with less administrative help than any of the 11 original collaboratives. A part-time director with the support of one half-time clerical is adequate to maintain a program, but seems too minimal to advance programming. Even though two half-time coordinators were added to the staff in February, it was too late in the school year for them to have an impact on collaborative programming. The decision to budget for a full-time director and a half-time coordinator, beginning in July, acknowledges the need to start the school year with a full staff. With this staffing pattern, a more expansive program seems to be possible.

There is a core of approximately ten teachers who serve on the Collaborative Council who have been loyal in their attendance and effective in working on collaborative activities. The five middle school teachers who were added to the Council during the year offer the potential to expand this core. However, none of the five newly appointed middle school members, who were at the April meeting, attended the May meeting. It is not apparent whether there are adequate strategies in place for bringing new members into the collaborative, providing them a history of what the collaborative has done, and supporting their immersion into collaborative activities. This seems to be important with any new member on a collaborative governing group and, in particular, when the members represent a group such as the middle school teachers, who had not previously participated.

The collaborative's unicameral form of governance has served to develop a group of people committed to the UMC project who are the mainstay of the collaborative. The plan to add a Board of Directors that will assume some of the responsibilities of the Council was approved during the 1988-89 school year, but has been very difficult to implement. One reason for this has been the time that it takes for someone to cultivate contact with the different groups that should be represented on the Board and to encourage them to designate someone to serve. There also is a question as to whether the difficulty of forming a Board of Directors is a reflection of the collaborative's posture within the St. Louis community. The initial rationale for creating a Council dominated by teachers was the development of an organization controlled by teachers for the good of the teachers. This has been achieved. Those teachers who serve on the Council feel very strongly that they are the ones who make the decisions. But, it seems that a price has been paid in that those from business and higher education, who were initially less involved, do not feel as much ownership and benefit from active participation in collaborative planning. One businessman who has remained involved, Bill Carroll of CNA, has been very committed to the collaborative and has supported its programs via his own participation, as well as through CNA's financial contributions. Bill Carroll and Jerome Burke have worked to develop a plan for increasing business participation. This is a step toward strategic planning that has been missing in the past and that, it is hoped, will strengthen community support of the collaborative.

EDC's consultant in St. Louis, Dr. Hyram, took a different approach to facilitating the establishment of the collaborative than had consultants hired for that purpose at other sites. Dr. Hyram's role developed more into that of an evaluator and friendly advisor than a facilitator responsible for setting up community links for the collaborative. There are several factors that probably contributed to this variation in the consultant's role. One is that, even though teachers on the Council had the highest esteem for Dr. Hyram, some were suspicious of why he was needed. The main emphasis in the development of the collaborative up to this point was on the teachers as the decision makers. Some teachers were not sure whether the local consultant in St. Louis would adhere to that principle. Furthermore, for Dr. Hyram, the importance of an urban mathematics collaborative went beyond the boundaries of the St. Louis Public Schools to include teachers from county districts. This, however, struck at a deep concern of the teachers that they have a program that they would not have to share with the county teachers. Some collaborative teachers have noted that the county teachers seem to have greater opportunities than do the SLPS teachers. This conflict in vision had to be resolved before other people could be brought into the process. Another factor in the attenuated support of the collaborative in the community seems to be the history of the collaborative and the development of a strong core group of teachers who were in control of it. Bringing this core group of teachers into a large meeting with others in the community to plan a vision for the collaborative, which had been done in other collaboratives, has the potential of overlooking the work done from the beginning by this teacher nucleus. What seemed to work better was to obtain feedback and advice from a neutral person who had not been as active in the process, and then have the group as a whole develop strategic plans for expanding the number of people involved from the community. The fact that EDC's strategy to hire an outside facilitator did not work may be an indication of the degree of empowerment of the active Council members.

### Collaboration

The concept of collaboration is filtering into the system, gradually increasing each year. The major energy behind collaboration in St. Louis derives from those who serve on the Council. But it appears that the dynamics of collaboration extends beyond this group. The committees that plan the Mathematics Fair and the Secondary Mathematics Contest are also developing cooperative working relationships and have been able to bring in people from business and the administration of the SLPS to be a part of collaborative activities, either as speakers or donors of funds. These two events serve to highlight mathematics in the eyes of teachers, students, administration, and the community. The Mathematics Fair, as well as the Contest, serve as an occasion for collaboration. The Fair has brought increasing involvement from universities, whose representatives participate as judges, and has generated positive media exposure, a rarity for the St. Louis Public Schools. The on-site observer commented about the Fair, "It is growing and becoming more impressive each year. I think it will become a permanent part of the school system. This was one of the best ideas to come out of the collaborative. I expect this to lead to clubs in schools and much more involvement of businesses." Up to now the focus has been on making collaborative events the best possible. It will be interesting to see whether the Mathematics Fair and the Contest can be used as leverage to get more people, teachers as well as others, cooperating in other ways.

Another form of collaboration that has roots specifically in the collaborative involves the mathematics supervisor who now has a group of teachers to draw from for service on committees. She is also using resources from business and higher education institutions in the region to help with the main inservice given in January. The inservice day is now conducted as a mini-conference, with teachers given the option to attend a choice of three sessions. The sessions are offered by people from the academic and business communities. Teachers now view this inservice in a more positive light than some of inservice programs they attended in the past.

The issue of isolation is still a problem to at least some of the teachers. A middle school mathematics teacher commented, "Each math teacher is essentially an isolated entity." At this teacher's school, none of the mathematics teachers have preparation periods in common, making it difficult for them to interact with each other.
As a result of collaborative programs which have involved teachers serving on committees, attending seminars, and socializing with their peers, this feeling of isolation has been reduced. During 1989-90, there was an increase in these activities; for example, 50 people attended the May dinner symposium in 1990, whereas 32 attended the previous year. The collaborative, however, has not developed a specific plan of action to reduce teachers' isolation in the schools as well as across schools. The St. Louis collaborative has matured to a point at which members know they can be successful working together and hosting events. This is a critical stage in the evolution of all of the collaboratives. For some it has taken a year. For others it has taken longer. It seems that conditions are such that another stage of development, such as identifying specific issues and problems facing mathematics teachers and working to solve these, may be imminent. Teacher isolation could be one of the issues addressed at this stage.

## Professionalism

The permanence proposal submitted by the St. Louis Urban Mathematics Collaborative to the Ford Foundation in April, 1990, lists a number of accomplishments of the collaborative. A high percentage of these were related to increasing the professional growth of mathematics teachers. Members of the collaborative reported that the collaborative had affected the intellectual growth of teachers and that teachers had become more active professionally through participation in symposia, workshops, lectures, and conferences. Not only are the mathematics teachers more active, in general, but they seem more willing to apply for grants to get involved in decision making and to try to influence the district's inservices. Teachers have expanded their reference group by serving on the Mathematics Fair and the Mathematics Contest committees and through attending other activities. The invigorated group of teachers serve as a pool for the mathematics supervisor when she selects her committees to address curriculum changes. What the proposal does not report, and what is not very clear, is the total number of teachers who have been affected by the collaborative in this way.

During the school year, a small group of teachers were asked to respond to questions on The Diary of Professional Relationships. Six teachers answered questions about teaching professionalism and six teachers responded to questions on teacher leadership. On teacher professionalism, the small sample responded similarly only on two of the six questions, indicating diversity in teachers' feelings about issues of professionalism. All of the teachers view themselves as teachers rather than as mathematicians because they attend to the whole classroom process, rather than functioning primarily as mathematicians, proving theorems or researching mathematical ideas. The teachers see themselves as concerned with the learning process and with guiding and directing students. The other issue of agreement was that St. Louis mathematics teachers are not engaged in evaluating other teachers. Department heads will visit classes of teachers and occasionally will express their opinions of other teachers. However, individual teachers do not have to nor do they assume a role of reflecting on others in their profession. Two of the teachers felt that they should not be involved in evaluating their colleagues. Three of them felt that there should be interaction among teachers through visiting each other's classes, demonstrating for each other, and offering support for each other. No mention was made of critically reflecting about what others do or of having teachers be accountable to their peers.

The teachers viewed their role in society as important, but varied in their opinion of exactly what that role was. One teacher felt that mathematics teachers provide society with individuals with knowledge and skills to solve problems in scientific and technological areas. Another teacher focused more on the idea that mathematics teachers provide students with skills that could be immediately applied in work or in higher education. A third teacher felt that the teachers' role in society was primarily to give the learner experience through assisting him/her to see spatial and quantitative relationships in the environment.

The teachers who responded did not agree fully on their role with regard to the curriculum and professional organizations. There was some variation by school and by mathematics department as to the role mathematics teachers have in curriculum decision making. Generally, the teachers felt they should have a larger role in determining the curriculum they use. One teacher stated explicitly that teachers should have 80 percent of the input into the curriculum, but actually only have 10 percent. Another teacher felt that teachers should be curriculum leaders and, in fact, this teacher and others from the same school are engaged in a pilot program toward that end. Professional organizations are seen as a source of new ideas and a means of staying current on the latest trends. Three of the teachers found professional organizations a source of motivation through providing inspiring and uplifting experiences. Half of the teachers liked what they gained from professional organizations in working and interacting with others. Only two of the six teachers viewed the role of professional organizations as that of situating people to serve on influential committees. None mentioned the generation of a political base by professional organizations. Four of the teachers reported that they were NCTM members; two listed the collaborative as a professional organization to which they belonged.

The six teachers, two of whom were occasional participants in the collaborative, all expressed in some way how the collaborative has enhanced their view of professionalism. One way in which the collaborative has helped them increase their knowledge of mathematics and teaching has been through additional training opportunities and through sharing with their peers. Some of the teachers indicated that the collaborative had offered them support and encouragement. One teacher provided a summary, "Participating in various workshops and conferences has increased my knowledge and awareness of available resources and thereby has made me feel more confident and capable of solving more of my own problems. Also, my creativity has been awakened and revitalized."

Five St. Louis mathematics teachers were asked questions about teacher leadership. All five are active teachers and are seen as demonstrating leadership qualities. As described by the on-site observer, one is a department chair, one has excellent ideas about education, one is an active council member and a hard worker, one spends time working on committees and doing extra jobs, and one attends conferences and seminars and speaks up at Council meetings. Four of the teachers are frequent participants in the collaborative and one is an occasional participant.

The responses of the five teachers to the questions about teachers as leaders did not give a coherent picture. Two of the teachers felt that teachers are role models for both students and other teachers and in that way exert leadership. A third teacher saw teachers as leaders if they take charge when something needs to be done. To do this, the teachers need to keep current with the latest trends. To a fourth teacher, a teacher leader was viewed as someone who is logical, progressive, and capable of intimidating the educational bureaucracy. Teachers who are leaders are action-oriented, but are seen by different teachers to take action in different forms. The teacher leaders are those who serve on committees such as the Mathematics Fair and Mathematics Contest committees and are active on the Collaborative Council. The qualities attributed to teacher leaders include communication skills, organization skills, and local organization participation. The collaborative was seen as an organization through which teachers are able to become leaders. The collaborative has encouraged teachers to be active and, by offering professional development opportunities, has provided teachers with experiences that have increased their potential for assuming leadership roles.

It appears that the collaborative was not considered as visible to teachers in 1989-90 as in previous years. One teacher felt that neither the collaborative nor EDC had done as much as they could have done. This teacher felt that the advancement of the collaborative has been stifled by the six-month review process required by the Ford Foundation and EDC and by the directors of the collaborative. She felt that the collaborative is good, but needs support rather than hurdles to deal with. Another teacher commented that the collaborative has to some extent supported teachers in assuming leadership roles, but did not do as much in 1989-90 as it has done in the previous years.

But when asked directly about its impact on their own development of leadership qualities, all five teachers spoke highly of the collaborative. The collaborative has created opportunities for mathematics teachers that were not available in the school system before. The opportunities listed included being involved with decision making, attending EDC's leadership conference, networking with other teachers, and being a catalyst to participate in such professional experiences as Title II classes. One teacher put it this way, "Yes, I have attended more workshops and conferences than ever before. Without the collaborative, I would not have known of many of these activities."

The collaborative has served as a proving ground for new ideas. It has given the mathematics supervisors support and a vehicle for trying ideas that would not have been possible within the standard structure of the mathematics program in the district. In 1988-89, the collaborative director along with the mathematics supervisor tried to organize subject area study groups, each focusing on issues related to a particular mathematics course. These groups did not succeed because very few teachers participated. However, in September, 1989, this idea was supported by the mathematics supervisor and the department heads were encouraged to form small clusters of teachers at each school to share possibilities and strategies and to develop recommendations for curriculum modifications. In October, 1989, the on-site observer reported that the department meetings had changed, "Department meetings are now more meaningful. Along with routine school business, problems in teaching mathematics are now discussed."

The collaborative has fostered certain professional attributes for at least some mathematics teachers in St. Louis. These mathematics teachers have become more active in professional organizations and through the collaborative have expanded their reference group. The teachers feel they are contributing to society by preparing students for work and for future education. They see themselves as teachers, as distinct from being mathematicians. The St. Louis teachers are less inclined to assume responsibility for self-regulation by taking a proactive stance in critically reflecting on the teaching of their peers and developing strategies for assuring that the teaching is of high quality. Mathematics teachers still do not have, or have not assumed, autonomy in making decisions regarding the curriculum they teach. There is more stimulus to curriculum activity, under the leadership of the mathematics supervisor, who encourages service on committees, but teachers still report having little influence on what they teach. Up to this point, the collaborative is largely identified with a small core of teachers who have increased their professional activity and have developed leadership skills. The missing ingredients in making a more significant impact seem to be reaching a greater number of mathematics teachers and having clearly defined goals that are supportable by a significant proportion of those teachers in the pool of potential members--those still to be reached.

## Mathematics Focus

The St. Louis Urban Collaborative does not have a well-defined mathematics focus. The Mathematics Fair and Secondary Mathematics Contest, two major functions sponsored by the collaborative, are directed toward improving students' interest in mathematics. The goal of the Mathematics Fair is to foster creativity, problem-solving skills, and interest in mathematics. The goal of the Contest is to improve test-taking skills and SAT scores. Both serve to communicate to teachers where attention should be focused, but the activities are not viewed as a means of increasing teachers' knowledge of mathematics, or of improving the teaching of mathematics.

To the extent that the collaborative has a mathematics focus, it comes from the mathematics supervisor and her initiatives in reforming the mathematics program in St. Louis Public Schools. In 1989-90, activities centered on using technology and problem solving in the classroom. An August computer seminar was sparsely attended. The January district inservice included sessions on teaching problem solving in algebra, the use of both scientific and graphing calculators, enhancing mathematics skills through problem solving and critical thinking, and the NCTM *Curriculum and Evaluation Standards*. The May dinner meeting featured a talk on problem solving in the curriculum. These activities serve to increase the awareness of teachers that mathematics is more than computation skills and provide them with information on how new technology can be applied to teaching.

Perhaps the greatest gain the collaborative has made for mathematics education in the district is to render it more visible to the teachers, their students, the district administration, and the community. Having highly visible events such as the Mathematics Fair and the Contest have contributed to this result. Elements of curriculum reform were apparent with the initiation of the new curriculum in 1988-89 and the emphasis on encouraging more students to take algebra. At least some of these changes have come about because the mathematics supervisor, Winifred Deavens, had the support of the collaborative and because she was actively participating in the national UMC network with other mathematics supervisors. Incremental change in mathematics education in the St. Louis School District is apparent. The collaborative has been influential in achieving this.

## F. Next Steps

In May, 1990, the St. Louis collaborative was granted permanence status by the Ford Foundation, but specific follow-up in certain areas was required as a condition for permanence. Three of the identified concerns were: 1) securing alternative sources of funding; 2) developing a viable program of activities; and 3) developing a permanent collaborative structure. Over the summer the Collaborative Council was to meet to address and define these concerns. As planning and funding issues are resolved, activities that had been suggested by the Council will be scheduled for the 1990-91 school year. In planning the activities, the collaborative will make an effort to offer activities that promote professional interaction between middle school and high school teachers. Furthermore, the collaborative plans to try to develop its program of activities so that they complement those being offered by the Mathematics and Science Education Center, the Regional Career Access Center, and the Network for Educational Development.

The activities scheduled for the summer of 1990 are diverse and offer numerous professional opportunities and experiences for collaborative teachers. Considered a St. Louis tradition, the annual Veiled Prophet Fair is held at the end of June and early July. As in the previous two years, the collaborative will sponsor a mathematics booth at the Fair on July 4, 1990. Three teachers will attend the UMC Teacher Leadership Workshop in New Hampshire in August, 1990; the collaborative will fund the attendance of one middle school teacher--an individual with a strong collaborative background--and EDC will fund the attendance of a second teacher. Seven teachers received collaborative funding to attend the summer Woodrow Wilson Workshop on Algebra July 9-13, 1990.

At the August 31, 1990 districtwide inservice, Gayle Coleman, a collaborative teacher, will receive the Loeb Award of $10,000 for outstanding mathematics teaching. In addition, one secondary and one middle school teacher were selected for $2,500 awards. Thirty-two other teachers were to be recognized, six of whom would receive plaques. The selection process was carried out during the 1989-90 school year.

Activities held annually and cosponsored by the SLPS and the UMC/STL are the Mathematics Fair and the Secondary Mathematics Contest. The Fair, which was held in March, 1990, and the Contest held in April, 1990, have proved so successful that planning is underway for both events for next year.

The St. Louis Public Schools' mathematics curriculum for grades K-5 and 6-8 will be under revision in the coming year, an effort directed by Mathematics Supervisor Winifred Deavens. Collaborative teachers have been asked to assist with the revisions.

# SUMMARY REPORT:
# SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the San Diego Urban Mathematics Collaborative (SDUMC) during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the San Diego Urban Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

# SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

The purpose of the San Diego Urban Mathematics Collaborative (SDUMC) during the 1989-90 school year has been to improve the professional lives of teachers in the San Diego area by reducing their tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community. In the continuation proposal submitted to the Ford Foundation in April, 1990, the three major concerns expressed in the mission statement were: reform in mathematics education, equity, and empowerment. Reform in mathematics education encompasses changes both in curriculum and in pedagogy. Equity refers to equal access to quality education for all students. Empowerment applies to teachers, parents, and the broader community impacting educational policy. The revised major goal of the San Diego Urban Mathematics Collaborative is that reform in urban mathematics education evolve within a framework of equity and excellence for all students. The vision is that meaningful contributions toward this goal can be made if teachers from the school district provide leadership in partnership with those from business, science, academia, and the school district administration. The SDUMC is regarded as the mechanism for assisting all mathematics teachers, the school districts, and the community in promoting equity in mathematics education.

## B. Context

The San Diego Urban Mathematics Collaborative (SDUMC) serves teachers in both the San Diego Unified School District (SDUSD) and the Sweetwater Union High School District. Each district is unique demographically, although they are in close geographic proximity. Individually, the districts present a diverse educational climate in which the collaborative must meet teacher member needs.

## The San Diego Unified School District

The metropolitan area served by the San Diego Unified School District has a population of one million within 209.6 square miles. Approximately 25 percent of the population is Spanish-Hispanic. The military exerts a major economic impact in the area, while the gradual emergence of high-technology industries in the city is causing an increasing demand for skilled workers. Tourism also makes a healthy contribution to San Diego's economic stability as the result of attractions like the world-famous San Diego Zoo and Balboa Park, which contains a number of cultural and scientific facilities in a multifaceted setting. The city also serves as a corridor for tourists who wish to cross the border and spend vacation time in Mexico and the Baja Peninsula.

The Board of Education is comprised of five members who are elected for four-year terms. Each member receives a salary of between $9,000 and $12,000 a year. Two of the members' terms expire in December, 1990. Thomas W. Payzant has been the Superintendent of Schools since 1982. Dr. Payzant, who has been considered a candidate for superintendencies in other major cities, had an annual salary of $110,000 under a four-year contract with a November 1, 1992 expiration date. As an endorsement of Dr. Payzant's performance and in an effort to retain him, the San Diego Board of Education last year revamped his contract with salary adjustments to provide $125,000 in July, 1990, and to reach $170,000 annually by 1993, the final year of a contract extension. His $7,000 annual expense account will increase by $500 per year and his monthly car allowance of $800 a month will be raised 5 percent annually. The new contract package places Dr. Payzant among the six highest paid superintendents in the country. After Los Angeles Unified School District, San Diego is the second largest district in the state and the eighth largest nationally.

In the spring of 1990, Dr. Payzant focused on specific objectives for the San Diego District, his primary goal being school-based management, which would allow teachers more autonomy for decision making. August 27, 1990, was designated as a workshop-conference day to explore the approach of individual schools to school-based management. Most recently, there was a concerted effort to offer schools the option of "restructuring" at the request of parents, school administrators, teachers, and other staff. Under new administrative directives, school staffs are being advised that restructuring efforts must apply to all student populations. Ethnic or other student groups that have exhibited poor test results must receive a more equitable educational focus and be integrated into the school-based management programs. Other goals included in Dr. Payzant's mission statement were the reduction of dropout rates and implementation of a new language arts curriculum at all middle-level schools and high schools by 1992.

School district expenditures for the 1989-90 school year were $543,524,684, with a projected 1990-91 budget of $585,000,000. Approximately 87 percent of the general fund budget income is provided by state and local revenues; 1.5 percent is provided through miscellaneous local sources, and 1.13 percent is provided by federal revenues. The SDUSD had a 9.77 percent carryover balance from the 1988-89 school year. District per-pupil costs are $3,965.

There are 179 schools in the SDUSD: 106 elementary schools (grades K-5/K-6); 8 middle schools (grades 6-7/6-8); 12 junior high schools (grades 6-8/7-8/7-9); 15 senior high schools (grades 9-12/10-12); a school of performing arts (grades 4-12); a secondary center for science/math/computers (grades 7-12); an alternative school (grades K-12); 2 continuation high schools (grades 7-12); 6 schools for the handicapped, and 27 children's centers. The district operates preschool centers for three- and four-year olds at 22 school sites. Thirty-two elementary schools and one middle school operate on year-round multiple- or single-track schedules of 45 days in session and then a 15-day break.

An estimated eight percent of all district students attend private/parochial schools and the percentage has not increased since 1988-89. School enrollment in 1989-90 totaled 118,134 (60,495 males and 57,639 females). There were 13,152 high school males and 12,540 females (total 25,692). Junior high school enrollment was 15,554, while middle school enrollment was 7,866. At the elementary level, the school population reached a total of 68,845. Special education for K-6 totaled 2,768; for grades 7 and 8, 673; and for grades 9-12, it was 918. Forty-two and a half percent (5,586) of the high school males were white and 42.01 percent (5,272) of the females were white; 14.5 percent (1,915) of the males were black and 15.7 percent (1,972) of the females were black; 21.3 percent (2,795) of the males were Spanish-Hispanic and 21.8 percent (2,736) of the females were Spanish-Hispanic; 21.2 percent (2,793) of the males were Asian/Pacific Islander and 19.9 percent (2,497) of the females were Asian/Pacific Islander; .5 percent (63) of the males were American Indian and .5 percent (63) of the females were American Indian. Pupil teacher ratios in grades K-3 are 29:1, and in grades 4-6, 31:1; no figures were available for the middle, junior, or high schools.

In 1977, San Diego City Schools implemented a district-wide Voluntary Integration program, which provides an increasing variety of educational program options. Enrollment in the district's Voluntary Ethnic Enrollment Program (VEEP) and 45 magnet programs is open to all students to whom ethnic enrollment criteria apply. The district provides transportation, at no cost to the parents, for students who attend magnet programs outside their geographic school boundary. Among special program offerings for grades K-6 and grades 7-9 are mathematics and science. At the 9-12 grade level, course offerings include mathematics and science for engineering and aerospace. At the 4-6 grade level, students are given an opportunity to participate in off-campus integrated learning experiences in Old Town, Balboa Park, and Camp Palomar. All district students participate in a comprehensive program focusing on race/human relations.

Of the total school population, 42.7 percent of the students during 1989-90 were in the government-funded lunch program and 24,815 were from families that received some form of public assistance. ESL (English as a Second Language) students number 21,871. The dropout rate at the high school level is eight percent for males and seven percent for females. The computation formula for ascertaining dropout rates is: fall enrollment minus spring enrollment divided by enrollment in grades 9-12, multiplied by 100.

Approximately 19,690 students (or 76.6%) were enrolled in mathematics courses during 1988-89. High school graduation requirements include six semester credits of mathematics in grades 9-12 and a passing grade on the mathematics proficiency tests, as well as the achievement of computer literacy.

California Assessment Program (CAP) test scores in reading for grade 12 students for 1989-90 were 251 and in mathematics 272, out of a possible 365. CTBS (Comprehensive Test of Basic Skills) scores for 9th- and 11th-graders in April, 1989, were in the 70th and 68th percentile respectively. When CTBS scores were broken into two segments, i.e., mathematics computation and mathematics concepts/applications, 9th-graders scored 72 on computation and 66 on concepts. Eleventh-graders scored 76 on computation and 71 on concepts.

There are 1,586 male and 3,725 female teachers in the SDUSD. Six hundred eighty-four of the high school staff are male; 642 are female. The ethnic population of high school teachers is: 577 white males and 507 white females; 39 black males and 62 black females; 39 Spanish-Hispanic males and 48 Spanish-Hispanic females; 14 Asian males and 17 Asian females; 15 American Indian males and 8 American Indian females. One hundred forty-one males and 57 females teach high school mathematics. The ethnic population of high school mathematics teachers is: 120 white males and 45 white females; 4 black males and 2 black females; 6 Spanish-Hispanic males and 2 Spanish-Hispanic females; 8 Asian males and 6 Asian females, and 3 American Indian males and 2 American Indian females.

The minimum teacher's salary in 1989-90 was $23,832, with a BA/BS, for a 184-day contract year; a maximum salary was $46,521, with a BA/BS plus 90 credits or an MA. The average salary in 1989-90 was $39,904. Inservice participation is voluntary and varies from teacher to teacher and by subject matter.

The current three-year contract commenced July 1, 1989, and will expire June 30, 1992; it was approved in November of 1988. Sixty-five percent of the teachers are members of the San Diego Teachers' Association, which acts as the bargaining agent for district teachers.

## The Sweetwater Union High School District

The Sweetwater Union High School District (SUHSD) is approximately four miles from the U.S./Mexican border. The population for the area included in the SUHSD numbers approximately 147,000 residents. The economy has a primarily commercial and industrial base and the majority of households are low-income.

The SUHSD has a five-member elected school board. Superintendent of Schools Anthony J. Trujillo came to the district in 1985 from Marin County, California. Sweetwater District is contiguous with other school districts, two of which have been actively involved in targeting some Sweetwater schools for possible unification.

In November, 1989, a 15-member study group of the National City School District (NCSD), which borders in part on Sweetwater, unanimously recommended that the NCSD seek consolidation of some of the schools by taking over three Sweetwater Union High School District secondary schools. A report by the National City District indicated that it would be difficult to win an election on the issue because unification would mean that the National City School District would acquire three secondary schools in need of repair and also be faced with the possibility of building a new high school. On the positive side, however, the district's ethnic population would be affected very little and teachers and other employees would earn higher pay. At present, students attend National City schools through 6th-grade and enter Sweetwater at the onset of 7th-grade.

Another unification attempt is being made by the South Bay Union School District, which wants to take over four of the Sweetwater District's secondary schools. South Bay residents have collected signatures in the Imperial Beach-Nestor-Otay Mesa area to put the question on a ballot in the fall of 1990. Pro arguments for the takeover focus on the poor physical condition of Sweetwater schools, inconsistency in the curriculum, and lack of accountability.

Sweetwater is seeking funding to begin reconstruction of some of its schools, including three secondary schools in the National City District; the district has a five-year maintenance fund for each of its schools.

In October and November of 1989, allegations of misappropriation of funds and widespread corruption were leveled at the Sweetwater District administration. The allegations were made by a former Sweetwater Union High School teacher who appeared before the Board of Education in October, 1989, claiming that he had proof to support his accusations. A county grand jury and the state auditor general's office subsequently made plans to probe district operations after these allegations were presented to the Board. The state audit was begun in January, 1990. The district attorney's office launched a criminal investigation of the school system after meeting with the teacher-informant. An independent auditing firm, hired by the Board in May, 1990, has investigated an issue of missing computer equipment and the misuse of lottery funds.

The district's general fund expenditures for the 1989-90 school year totaled approximately $120,000,000. The State of California provides approximately 70-75 percent of the total monies allocated to the district. The federal government provides 5-6 percent of the Sweetwater budget, and the remainder comes from local revenues. Two collaborative schools, Sweetwater High School and National City Junior High School, have gone to a year-around schedule.

There are 20 schools in the Sweetwater Union High School District: 2 middle schools (grades 7-8), 1 of which is a magnet school; 3 junior high magnet schools; 4 junior high schools (grades 7-9); 9 senior high schools (two grades 9-12 and six grades 10-12), 5 of which are magnet schools, and 2 learning centers. The magnet programs include courses in computer science, mathematics, science and computers, business, language, college preparation, and creative and performing arts. One of the junior high magnets, the NOVA + program, emphasizes analysis, discussion, and composition as they relate to four academic areas--English, mathematics, science, and social science.

Over 27,200 students were enrolled in the Sweetwater Union High School District in 1989-90 and approximately 75 percent of K-12 students were from underrepresented groups. The ethnic population was as follows: 57.2 percent Hispanic; 25 percent white; 10 percent Filipino; 4 percent black; 3.2 percent are Asian/non-Filipino; and .6 percent are American Indian. Since 1988-89, enrollment has increased from 26,844 students to the current total of 27,266 students. Approximately 30 percent of the student population was eligible for federally-funded lunch programs.

Nearly 13 percent (3,510) of the SUHSD student population considered English a second language. A continual increase in the Limited English Proficiency (LEP) student numbers in the district has created a shortage of bilingual mathematics and science teachers.

A total of 11,465 students were enrolled in the district's middle and junior high schools. Of the combined middle/junior high school student population, 54.7 percent (6,274) are Hispanic; 27.1 percent (3,112) are white; 9.9 percent (1,130) are Filipino; 4.5 percent (521) are black; 2.4 percent (276) are Asian/non-Filipino; .6 (64) percent are American Indian; and .8 percent (88) are from other underrepresented groups.

The SUHSD enrolls 14,532 senior high school students. Of these, 59.1 percent (8,586) are Hispanic; 23.2 percent (3,370) are white; 10.4 percent (1,514) are Filipino; 3.5 percent

(504) are black; 2.5 percent (370) are Asian/non-Filipino, and .6 percent (85) are American Indian. Students in the district scored at or above the national average on the Comprehensive Test of Basic Skills (CTBS) Form V. On the California Assessment Program (CAP), the 1989 senior class scored at the 53rd percentile in reading, the 77th percentile in mathematics, and the 57th percentile in direct writing. Graduation requirements include three years of mathematics.

Approximately 1,084 teachers are employed by the district. Fifty-two percent of all teachers are female. The ethnic population of teachers is: 77.39 percent (839) white; 17 percent (186) Hispanic; 1.66 percent (18) black; 2.9 percent (31) Filipino; and 1 percent (10) American Indian. All Sweetwater teachers belong to a teachers' union. All teachers receive some paid release days for inservice and other teacher-training purposes. All of the teachers have at least a bachelor's degree. Salary minimums for a teacher with a BS/BA are $22,316, and $48,400 for the teacher with a doctorate, or a master's degree plus 45 semester units subsequent to a master's.

## Professional Development Opportunities for Teachers

San Diego State University and the University of California-San Diego have provided a fertile environment for the cultivation of mathematics projects in the San Diego area, particularly in cooperative efforts with the SDUSD public schools.

The Center for Research in Mathematics and Science Education (CRMSE), located on the San Diego University campus, is the host agency for the collaborative. CRMSE has developed one elementary school mathematics enrichment program in southeast San Diego, the Kennedy School Mathematics Project, which is directed by Nadine Bezuk, associate director of CRMSE. The program includes an afterschool Mathematics Club for 50 students in grades K-6, an annual Student Math Fair, and the involvement of 23 student teachers who are active in the Family Math Fair.

San Diego State University Professor Nicholas Branca was awarded funding from the California Mathematics Project for the second year of the three-year San Diego Mathematics Project (SDMP). The project, a joint effort of SDSU and the San Diego County Office of Education, is designed to develop the leadership potential of K-12 mathematics teachers in order to improve the quality of mathematics instruction in San Diego and Imperial Counties. The project's emphasis is on mathematics curriculum, problem solving, and effective teaching strategies. Dr. Branca is also a member of the NCTM working group that is developing the Professional Standards for Teaching Mathematics. During the summer, several SDMP participants, including K-12 teachers, worked on planning miniprojects held at several San Diego County locations. A retreat for participants was held in May, 1990, at Lake Arrowhead to continue planning and preparation for 1989-90 activities.

SDMP sponsored three miniprojects during the 1989-90 academic year. Each project focused on improving mathematics instruction at the school site level. Opportunities were made available to participants to interact across grade levels as well as within levels. Sessions also focused on current issues in mathematics education with an emphasis on problem solving and effective teaching strategies. Additional topics included equity issues, evaluation and testing, and the role of calculators and computers in mathematics programs. Each session was conducted as a model of cooperative learning, discussion group activity, and other appropriate teaching techniques. Each miniproject lasted for five days with follow-up meetings in the fall and spring. Up to ten collaborative teachers participated in miniprojects.

Douglas McLeod, SDSU and Washington State University, worked with Lena Khisty of Washington State University on A Naturalistic Study of Mathematics Teaching with Hispanic Bilingual Students. The project explored linguistic factors which contribute to or interfere with the acquisition of mathematical knowledge by bilingual students.

Judy Sowder, of CRMSE, hosted a conference during the 1989-90 school year titled "Establishing Theoretical Links," an extension of her project, Relating Mental Computation, Number Sense, and Computational Estimation. The conference program included presentations by cognitive psychologists and mathematics educators who discussed theoretical links between cognitive theories of learning and mental computation.

A colloquium series that covered several mathematics and science topics was presented by CRMSE on the San Diego campus during the school year. A number of new projects related to mathematics, science, and computers have been announced by CRMSE. A newsletter, *Quest*, is published by CRMSE periodically.

In 1987-88, Frank Holmes, a member of the SDUMC Executive Committee and director of the minority engineering program at San Diego University, was awarded a $430,000 NSF grant to fund a minority mathematics enrichment program. The first of its kind in the nation, the program completed its third year in 1989-90. A major program goal is to promote further study of technical subjects by children from ethnically diverse backgrounds and to bring together a group of ethnically diverse teachers who will put special emphasis on mathematics. During its first three years, the program has provided children in grades 2-4 additional mathematics instruction using a variety of role models. Approximately 180 2nd- and 3rd-graders were involved in after-school mathematics activities three days a week, with instruction provided by specially selected teachers and college students. Dr. Uri Treisman and Dr. Larry Sowder were actively involved in the program and Dr. Nadine Bezuk of CRMSE served as the program evaluator. Community and church involvement in a variety of support systems were integrated into the project and corporate representatives served on the Advisory Board.

During 1989-90, mathematics teachers at Granger Middle School participated in the second year of a three-year staff development program funded by a $50,000 grant. This grant from the California Middle School Mathematics Project was awarded in response to a 1988 proposal from a mathematics teacher who had been at the Technology Center before its money was withdrawn by the state. The funds are used to finance workshops and other experiences for mathematics teachers at Granger. Sometimes teachers from other collaborative schools are included.

During the summer of 1989, there were several opportunities in the San Diego area for mathematics staff development. A Project EQUALS workshop was held July 10-13, 1989, at the County Office of Education--the first EQUALS workshop to be offered by the San Diego County Office. The four-day workshop series was designed to encourage mathematics participation by underrepresented populations of students, particularly women and minorities, in mathematics classes. The workshops offered both strategies and materials to attract and encourage all students, modeled instructional techniques, generated enthusiasm on the part of teachers, counselors, and students, increased awareness of career options and interest in mathematics-related occupations, and provided a continuing network of support for EQUALS educators.

The Society for Industrial and Applied Mathematics (SIAM) held its annual meeting in San Diego during the summer of 1989 and, as part of the meeting, sponsored a "San Diego Teachers' Day" on July 20, 1989. The program included John Dossey, Illinois State University, who spoke about the NCTM *Standards*. Ken Hoffman presented information about the Mathematics Science Education Board, and six mathematicians discussed contemporary applications of mathematics and the mathematics needed in the current workforce. Many collaborative teachers were among the 110 local teachers who participated in the day-long event. The collaborative helped to organize the meeting and distributed information about the meeting to teachers in the area.

A wide variety of opportunities for professional development were also available during the 1989-90 school year. The 17th Annual National Conference of the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers was held April 9-14, 1990, at the San Diego Hilton Beach and Tennis Resort. The highlights included a student program, a junior and senior high school science fair competition, discussion of career goals with a panel of professionals in science, mathematics, and engineering, and a science magic show. The junior high fair competition was won by a team from Keiller Middle School, a collaborative school. The conference also included a black college fair hosted by representatives and/or alumni from black colleges and universities. Information on recruitment, scholarship, and financial aid was provided.

A number of professional development programs and grants are available for teachers in the San Diego district. GTE, for example, sponsored a $12,000 grant program, Growth Initiatives for Teachers (GIFT), for public and private secondary school science and mathematics teachers (grades 7-12) in 20 states, including California. The program, designed to encourage innovation and teamwork in teaching mathematics and science, required that a science and mathematics teacher from the same school apply as a team for a grant. The team shares a $12,000 grant--$7,000 for a school enrichment project and $5,000 ($2,500 for each member of the team) for professional development.

The American Association of University Women (AAUW) Educational Foundation has established a new sabbatical fellowship program for full-time K-12 female classroom teachers, as the first component of its Eleanor Roosevelt Fund for Women and Girls, in a coordinated effort to develop programs and activities to support the educational achievement and development of self-esteem in women and girls. The fellowships are designed to enrich teachers' instruction of girls in mathematics and the sciences or to address the self-esteem of students and increase the success of minorities in any subject area. Sabbatical periods are flexible and can last from a few weeks to one school year. Up to 50 sabbaticals, with stipends ranging from $1,000 to $10,000, may be awarded.

The California Mathematics Council-Southern Section (CMC-SS) promoted its Fifteenth Annual Program of Scholarships and Grants to advance interest in mathematics and excellence in the teaching of mathematics. Scholarships range from $100 to $1,000 and are available to education students in credential programs and to teachers who are members of CMC-SS.

Cosponsored by NASA and the National Science Teachers Association in cooperation with NCTM, nine aerospace education workshops are presented annually for outstanding elementary and secondary teachers. The elementary program is known as NEWEST and the secondary program as NEWMAST. Secondary applicants must be teaching in a junior or senior high school over 50 percent of the time and have three years of experience. Selected applicants receive travel, housing, and per diem expenses.

### C. Development of the Collaborative

A new form of governance structure for the San Diego Urban Mathematics Collaborative was initiated at the beginning of the 1989-90 school year. A bicameral structure was adopted that provided for a 25-member Board of Directors and a Council of Mathematics Educators, including one representative from each of the 9 targeted schools. The administrative staff remained in place until March 31, 1990. Alma Marosz, Center for Research in Mathematics and Science Education (CRMSE), San Diego State University, continued to serve as the collaborative's director. She was assisted by a half-time coordinator, Barbara Wyman. In February, the Council of Mathematics Educators recommended to the Board of Directors that a San Diego Unified School District mathematics resource teacher serve as half-time coordinator/director for the collaborative. William Wible was appointed to this position on May 9. Alma Marosz was available through July to assist with the transition. Her time was an in-kind contribution from San Diego State University. Mr. Wible, who maintains his office at the SDUSD administration building, and serves under Dr. Vance Mills, the district mathematics supervisor. Administrative assistance for the director and coordinator is provided by CRMSE and by the Mathematics Science Office. The on-site observer is Dr. Sharon Whitehurst, the Affirmative Action Program administrator for the San Diego Unified School District.

### Board of Directors

The Board of Directors was officially instated at the September 6, 1989 Community Steering Committee meeting. The Community Steering Committee agreed to the organization of the Board of Directors, to the by-laws, and to the nomination of officers as recommended by a five-member ad hoc governance committee, a subcommittee of the Steering Committee. The 14 members of the Steering Committee formed the initial core group of the Board. The Board of Directors is a 25-member committee vested with responsibility for determining policy for the collaborative. Membership on the Board is comprised of: 4 SDUMC teachers (including the chair of the Council of Mathematics Educators), 9 persons from business/industry/military, 4 from science education and the university, 3 school district personnel (1 each from San Diego City Schools, Sweetwater Union High School, and the San Diego County Board of Education), 2 from community services, and 3 parents. The first Board members were given terms of two, three, or four years. In the future, directors are to serve three years with one-third of the members elected each year. At the September 6 meeting, Fred Larsen, U. S. Navy, was elected chair; Dorothy Smith, SDSU, was elected vice-chair, and Rodene Gosselin, Sweetwater High School, secretary. Possible committees of the Board identified at the time of its formation are finance, by-laws, mathematics education awareness, long-term planning, industry-teacher articulation, parent-teacher articulation, and executive. Membership on the committees is not restricted to those on the Board; others, including teachers, are encouraged to participate by becoming committee members.

The Board of Directors is scheduled to meet quarterly. In 1989-90, in addition to the initial meeting on September 6, the Board met three times; an emergency meeting was held on January 8 and two regular meetings on January 31 and May 2. Meetings are held at the Education Center of the SDUSD from 5:00 to 6:30 p.m. In January, the group met with Brian Lord, EDC, to receive an update on the San Diego permanence proposal. The EDC representative expressed concern with the proposal that had been submitted in November. Among the issues raised were the lack of written commitments from SDSU and SDUSD, the need for a comprehensive plan for the future, and the lack of a clear indication of teachers' involvement in the development of the proposal. Other issues addressed had to do with determining what agency would host the collaborative and how it should be administrated. The group reached consensus on the host issue, agreeing that the collaborative should remain at CRMSE for the next three years while making a concerted effort to gain status as a non-profit organization. One solution to EDC's concern about a possible conflict in having the collaborative director appointed by the board and the fiscal agent appointed by SDSU was to give the director adjunct faculty status. Another action taken was to have the teachers develop a list of objectives, activities, time lines, and resources based on the goals they developed at their 1989 Spring Retreat.

In the interim between the January 8 emergency meeting and the January 31 regular meeting, a strategic planning group of the Board, composed primarily of teachers on the Council of Mathematics Educators and a few other Board members, met three times. This group developed a budget, timelines, and goals for the collaborative. At one of these meetings, it also was noted that the collaborative had received written support from the deputy superintendent of SDUSD. On January 31, the Board of Directors met to receive an update on strategic planning. The recommendations of the planning group were accepted. The group decided that the collaborative was not ready to hire an executive director at the time. Instead, a teacher or someone who was associated with the SDUSD could be hired to handle the duties of executive director; then, toward the end of three years an executive director, supported by a part-time coordinator, could be hired for fund raising.

The final 1989-90 meeting of the Board of Directors was held on May 2. This meeting was designed to inform members about the current reforms in mathematics education so that they could think through the relationship between reform reports and the goals of the San Diego Urban Mathematics Collaborative. The discussion was led by Nicholas Branca and Alma Marosz of SDSU and by collaborative teachers.

## The Council of Mathematics Educators

The Council of Mathematics Educators was convened for the first time on September 14, 1989, at National City Junior High School. This group assumed the role of what was formerly the Executive Committee. Twelve people attended this meeting, including 9 teachers, 1 representative from the San Diego County Board of Education offices, 1 from SDUSD, and the collaborative director. The Council was formed for the purpose of enabling representatives from each targeted school to meet monthly to plan activities for the collaborative and to facilitate communication among the teachers of the collaborative. The Council has three committees--activities, by-laws, and budget. The meetings are held after school, at 3:30 p.m., at one of the collaborative schools. If the designated representative cannot attend, the representative is expected to send an alternate. Andy Ashcraft, a teacher at Lincoln Preparatory School, served as chair of the group in the beginning. In February, Ron Tsui, a teacher at Wilson Junior High School and chair of the activities committee, began serving with Andy as vice-chair of the Council.

From 8 to 12 people attended the monthly meetings held during the 1989-90 school year. Discussions at the meetings included announcing future activities and deciding on how to select those who should receive collaborative funds to attend such meetings as the NCTM Annual Meeting. At its October meeting, the group reflected on the October Fall Retreat and what could be done to improve it. In addition, they discussed ways to give teachers access to available mathematics films. In November, the relationship between low attendance at the previous two activities and the extensive staff development work being carried out by mathematics departments was discussed. Proposals considered for increasing participation included having a program for teachers interested in working toward a master's degree and increasing the number of targeted schools in the collaborative. The representatives were to discuss these issues with other teachers in their departments. In addition to discussing future activities, the Council spent time at its December, January, and February meetings discussing issues related to the permanence proposal. At the February meeting, Vance Mills proposed that a SDUSD resource teacher serve as a half-time coordinator/director for the collaborative. This was approved by the group and then submitted to the Board of Directors for consideration.

At its April 16 meeting, the Council received word from Ms. Marosz that the permanence proposal had received EDC's approval and had been forwarded to the Ford

Foundation. Members of the Council felt that responsibilities for the management of the collaborative had to be more clearly defined as the time approached for appointing a resource teacher as half-time coordinator/director. Council members were asked to discuss this topic with other teachers from their schools. In other activity, the Council opened the Advanced Graphic Calculator Workshop, scheduled for April 28, to teachers from five high schools that may be targeted by the collaborative in the future. This workshop was eventually canceled. It was noted that teachers from eight junior high schools, identified as future collaborative targets, would be invited with collaborative teachers to attend a beginning graphic calculator workshop projected for late in the year. The final Council meeting was a joint meeting with the Board of Directors held on June 12, 1990, at the Chula Vista Nature Center.

### Permanence Proposal Process

A significant amount of effort was expended during 1989-90 in planning and preparing the permanence proposal to the Ford Foundation. In May, 1989, Dr. Arthur Ellis was hired as a consultant by EDC to help direct efforts to include parents and representatives of business in the collaborative as plans were being formulated for its permanence. The first activity involving community and business members was a breakfast held on June 26, 1989. More than 30 people attended the 7:30 a.m. meeting at the Doubletree Hotel in Mission Valley. Participants included 6 teachers, 3 administrators of the collaborative, 3 school administrators, 3 current and former school board members, 10 representatives from business and the military, 4 from higher education, 2 PTA representatives, and the on-site observer. The purpose of the meeting was to acquaint participants with the goals and activities of the collaborative and to solicit their support and involvement; participant response was very favorable.

A Community Steering Committee, consisting of those who expressed interest at the June 26 breakfast, was formed. This group met on July 18, August 15, and on September 6, when it became the nucleus of the Board of Directors. The July 18 meeting was hosted by Murray Galison, president of the San Diego National Bank, and held at the National Bank's Board room at 4:00 p.m. The 30 people who attended, including teachers, parents, SDUMC staff, and a variety of community representatives, discussed the mission of the collaborative, focusing on three themes--equity, excellence, and access. Dr. Ellis, the

EDC consultant, facilitated this discussion. Andy Ashcraft, a teacher and future chair of the Executive Committee, discussed the goals of the collaborative. Rodene Gosselin and Alma Marosz presented information on the role of the Executive Committee. The group established the Governance Sub-Committee which was charged with defining a governing structure that would assume responsibility for the permanence of the collaborative. This group was to report back to the Community Steering Committee at its August 15 meeting. Drafts of the governance structure and by-laws were refined at the August meeting.

The ad hoc Governance Sub-Committee of 14 members met July 31. This group decided on the administrative structure for the collaborative and specified that the Board of Directors would have 25 members. A five-member group--Arthur Ellis, Andy Ashcroft, Rodene Gosselin, Fred Larsen, and Alma Marosz--met on August 22 to draft by-laws for the Board of Directors and nominate a slate of officers. This group resolved the questions raised by the Steering Committee at its August 15 meeting.

On September 6, the Board of Directors met for the first time. Members of the Steering Committee were asked to serve on the Board. The response was so favorable that the size of the Board was thereby increased from 25 to 30 members.

In November, 1989, a proposal was submitted to the Ford Foundation for the continuation of support for the San Diego Urban Mathematics Collaborative. This document, based on the work that the collaborative had done in developing a new structure, articulated the main goals for the collaborative, plans for the housing and governance of the collaborative, some of the background of the planning process and the activities that the collaborative had organized, tentative activities for 1989-90, and a budget. This proposal was a second draft of one that had been submitted to EDC and to which EDC had responded in a letter on October 6, 1989. The concerns expressed by EDC with respect to the final proposal in November focused on the absence of concrete commitments to the collaborative's financial future, including the fact that there was no clear commitment from SDUSD and SDSU. To resolve these issues, EDC recommended that a formal subcommittee be convened to address what was essentially a financial issue. In particular, the committee was charged with providing a more complete picture of the collaborative's fiscal and governance arrangements, a budget assuring that the bulk of Ford Foundation funding is not to be expended on the administration of the collaborative, and a detailed outline of the collaborative's future programs and activities. Dates specified by

EDC for reviewing the progress of the collaborative in developing its plans included February 1, 1990, for review of the committee's progress; October 1, 1990, for a six-month review, showing acceptable progress as a prerequisite for submitting a continuation proposal February 1, 1991; and April 1, 1991, for a final review to determine whether sufficient progress has been made to ensure a final award by the Ford Foundation.

Based on the response from EDC, a Strategic Planning Committee was formed. This group met three times in January to outline in greater detail the governance of the collaborative and its goals. Committees of the Council of Mathematics Educators developed a comprehensive plan for collaborative activities. A more detailed revised version of the permanence proposal was submitted to EDC on April 6, 1990. A main section of this proposal focused on strategic plans. Attached to the proposal were a number of letters in support of the collaborative, including endorsements from officials of SDUSD and SDSU. Shortly after the proposal was submitted, word was received that the proposal had been approved by EDC and forwarded to the Ford Foundation.

## Target Schools

The mathematics teachers at the nine schools targeted for collaborative participation in 1988-89 were targeted also in 1989-90. The nine schools included: three high schools (Lincoln Preparatory, San Diego, and Morse) and two junior high schools (Bell and Keiller) from the San Diego Unified School District; two high schools (Sweetwater and Mar Vista) from the Sweetwater Union High School District; and two junior highs (National City and Granger) that are feeder schools to Sweetwater High School. The initial plan was for the original collaborative to be expanded by adding a high school and its feeder junior high schools. At the beginning, the collaborative included three high schools and three junior high schools. In its second year, a decision was made to expand by three more high schools, but not to include their feeder junior high schools. One reason given in the permanence proposal for doing this was that the high school teachers seemed reluctant to become active in the collaborative. The strategy was to open the collaborative to high school teachers for a year, get them involved, and then include the junior high school teachers. This approach was used in 1987-88. Expansion to the feeder junior high schools did not take place in 1988-89, as planned, because of the illness of the coordinator who was unable to guide the process. The expansion did not take place in 1989-90 because of the time and effort that was spent building the governance structure and writing the permanence proposal.

## D. Project Activities

In addition to encouraging teachers to take advantage of the wide array of opportunities for professional development offered by local resources, the San Diego Urban Mathematics Collaborative sponsored a variety of activities to encourage professional development and collegiality among collaborative members. The collaborative also provided funding for teachers to attend state, regional, and national workshops and conferences.

### Workshop on Contemporary Applied Mathematics

The San Diego Urban Mathematics Collaborative invited Dr. William Sacco of Tri-Analytics, a consulting firm that solves mathematical problems for industry, to present a workshop on contemporary applied mathematics. In addition to owning Tri-Analytics, Dr. Sacco is one of the authors of a workbook series on applied mathematics. The workshop, which was designed for teachers of grades 7-12, was held from 9 a.m. to 4 p.m. on Saturday, November 4, 1989, at the Hyatt Islandia. Nineteen participants, including 16 collaborative teachers--11 from the SDUSD and 5 from the Sweetwater Union High School District, 1 representative from higher education, and 2 members of the Los Angeles UMC +PLUS+ Project--attended the workshop. Participating SDUMC teachers received a $50 stipend, a complimentary lunch, and, if requested, continuing education credits.

The teachers' responses to the workshop were very favorable, with 10 of the 12 teachers who completed the written evaluation form rating the overall workshop a 4 or 5 on a 5-point scale, with 5 being the highest. The remaining two teachers rated the workshop a 3 and a 3.5. All of the teachers who completed the evaluation form indicated that the workshop was useful. When asked to indicate what was most useful about the workshop, responses included, "Everything--the graphs, the applications"; "The dynamic programming"; "The examples of real life situations (cutting edge at times) and the innovative ideas, i.e., graphics"; and "Everything! Loved all of this." When asked by the on-site observer for comments on the event, a teacher said, "Inspirational, I can now see how to interject the latest math concepts into traditional courses. Good location, nice lunch, great presentation. Lots of free materials to help implement ideas!"

## Collaborative Retreat

The fourth annual retreat for members of the San Diego Urban Mathematics Collaborative was held October 6, 1989, from 4 to 10 p.m. at the Business Administration and Mathematics Building of San Diego State University. The theme of the retreat was "Technology in the Classroom." Participants had the opportunity to make selections from 11 one-hour workshops which were offered 4:30-6:30 p.m. and 8-10 p.m.; dinner was served between 6:30 and 8 p.m. The topics of the workshops included geometric probability, problem-solving strategies using Logo, and a robotics demonstration.

Forty-one people participated in the retreat, including 34 collaborative teachers representing 3 junior high schools and 6 senior high schools; 1 noncollaborative teacher; the collaborative director, coordinator, and on-site observer; a school administrator; a representative from business; and a member of the Urban League. Each teacher who attended received a $50 stipend from the collaborative.

The teachers seemed to feel that the retreat was successful. One teacher commented, "I enjoyed being with other teachers to learn from them. I enjoyed the activities and the event was helpful." A second teacher added, "All topics were good. I wish I could have spent more time in one or no more than two workshops. 'Graphic Calculators' and 'Green Globs' were my choice of workshops." A third teacher said, "'The Casio Graphic Calculator'--good info but [the workshop] went by fast for a first timer. 'The *Green Globs* [software]' in the Math A Workshop was fun--helpful to hear that it is used by a wide range of ability levels. 'Teaching Math Concepts with Calculators'--appreciate the humor and frank talk that the calculator is only a tool but not the only one. 'Math Videotapes Workshop'--could use info on availability, cost. General reaction was good fellowship, good meal, good presentations." A fourth teacher remarked, "Well-organized--very worthwhile." A fifth teacher noted, ". . . worthwhile and nice and I'm surprised no one fell asleep considering the hour! I appreciate everyone's efforts."

The on-site observer reported, "Although the activity was fairly well attended, it was not as interesting as last year's retreat. Perhaps the place had something to do with it . . . . Teachers were more subdued in their reactions. Teachers were more instrumental in putting this retreat together."

### Colloquium on the NCTM *Professional Standards for Teaching Mathematics*

The collaborative and the San Diego Mathematics Project sponsored a colloquium on April 4, 1990, from 4 to 9 p.m. to discuss the draft of the NCTM *Professional Standards for Teaching Mathematics* at San Diego State University. Participation was to have been limited, but everyone who applied was accommodated. Nearly 50 educators participated in the colloquium, including 8 collaborative teachers and the collaborative director, as well as 2 guests from the newly formed collaborative in Columbus, Georgia. Participants received a $50 stipend and a complimentary dinner. In addition, each participant was sent an abbreviated draft of the *Professional Standards* prior to the colloquium.

The afternoon began with an overview by Dr. Nicholas Branca on how the NCTM draft was prepared and the key role of local educators in the overall developmental process. Dr. Branca is the director of the San Diego Mathematics Project and a member of the working group that developed the *Professional Standards*. Dr. Branca presented a series of questions that the Commission had considered in developing the draft. Following the overview, the participants broke into four groups, each of which focused on one of the following areas: (1) Standards for Teaching; (2) Standards for Professional Development (K-8); (3) Standards for Professional Development (secondary level); and (4) Standards for Evaluation. During the last half hour of the colloquium, the groups reassembled and briefly summarized their respective discussions.

Overall the participants seemed to support the message behind the document, but had a great many specific suggestions for revisions. The general comments from Group #1 included, "The format and organization of the draft was a consistent concern for virtually all of the colloquium participants. The format used in the NCTM's *Curriculum and Evaluation Standards for School Mathematics*, however, is thought to be a very good format model." Group #2's general comments included, "A summary document should be helpful and beneficial to mathematics educators." Group #3 identified a subtly negative "attitude" toward teachers that it perceived in the draft. Members commented, "Teachers aren't presumed to want to be professional. We regard this as an erroneous perception and feel there isn't enough emphasis or credit given to educators' desire to be 'professional.'" Group #4's general comments included, "In general, the examples provided need to be refined and/or annotated to clearly show readers what the point is. The draft is too vague in too many places. Tighten up examples. Why do the examples focus on what is 'poor' methodology? Use some great/good examples up front, then explain the *Standards* as they relate to these examples. Eliminate negative examples."

A preliminary draft of the participants' reactions and responses to the NCTM *Standards* was compiled and sent to each participant for further comments, revisions, additions, and suggestions. Their comments were then reviewed by consultant and former collaborative Coordinator Jean Childs-Moore, and the revised critique was sent to the NCTM Commission charged with revising the document.

### Social Hour and Celebration Dinner

The collaborative hosted a social hour and celebration dinner for its Board of Directors and the Council of Mathematics Educators on June 12 at the Chula Vista Nature Center. The purpose of the event was to celebrate the collaborative's funding for the next two years and to enable members of the standing committees to discuss plans for the upcoming year. The event also provided an opportunity for Board members to meet William Wible, the newly appointed Secondary Mathematics Resource Teacher for the San Diego City Schools, who would be working closely with the collaborative. A total of 23 current and ex-officio members of the Board attended the event, which was held from 6 to 7:30 p.m., following an afternoon business meeting of the Board. Participants included 15 collaborative teachers; the Collaborative Director Bill Wible, the retiring director, and on-site observer; 2 representatives from higher education, and 2 from business.

The participants felt that the activity was successful, although the on-site observer noted that people seemed confused about the purpose of the event.

One teacher remarked, "Yes, the activity was worthwhile. I was sort of on the outside. . . .There wasn't a lot of focus. Purpose was to get more of us involved." A second teacher said, "It was worthwhile. General meeting to meet other teachers and to meet the new resource teacher. Strengths--networking. Weaknesses--we're not structured in a way to make decisions easily. I'd like to see how Bill handles things we asked him to do. We're hoping to get our teachers involved in a master's program in mathematics." The on-site observer reported, "It was a nice activity. Driving to the building was a problem, but it was worth it when I got there. Teachers were confused about the purpose. Dinner was served and people mixed together."

### Master's Degree Program

The mathematics teachers at Abraham Lincoln Preparatory High School, a collaborative school in the San Diego City Unified School District, expressed interest in San Diego State University establishing a master's degree program with an emphasis on mathematics education at Lincoln High School. The university was in the process of developing a master's degree program that would be targeted toward middle school and secondary teachers. The department head and other mathematics teachers at Lincoln High School expressed interest in a degree program that would offer a greater number of mathematics courses than were featured in the existing master's program. Alma Marosz and Judy Sowder felt that input from teachers would help move the program forward in the university approval process. They suggested that the teachers offer their input. As a consequence, several mathematics teachers at Lincoln High School wrote a letter to the Dean of the College of Science in the fall of 1989. The teachers wrote, "We are currently members of the San Diego Urban Mathematics Collaborative and as a result of our involvement with the collaborative, the need and interest for post-graduate work in math education has become apparent. . . .We all agree that a mathematics educational emphasis could make our classrooms the laboratory testing grounds for improving mathematical understanding among our students. We believe that sound instructional practices and strategies are the keys in reaching inner-city youth." In addition to sending this letter, the department head encouraged other Lincoln High teachers to participate in the program.

After several months, a special meeting was called by the department chair at Lincoln High School on May 16, at which Dr. Judy Sowder discussed SDSU's proposed Master of

Arts in Teaching Degree Program for Secondary Teachers. The purpose of this meeting was for teachers to learn more about the degree program and to have their questions answered. By this time, the program had been approved by SDSU.

## Regional and National Conferences and Workshops

During 1989-90, representatives on the Executive Committee established guidelines for subsidizing teacher attendance at conferences and workshops. The representatives were asked to support teachers' conference attendance, particularly those who had not participated in conference activity previously.

### Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for local change tied to an issue critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC had agreed to cover the expenses (transportation, registration, room, and board) for two teachers from each collaborative. SDUMC teachers who were interested in attending had to complete an application and then were interviewed by members of the collaborative's Planning Committee. One teacher who attended remarked that the workshop was "positive and worthwhile."

## Annual Conference of the Southern Section of the California Mathematics Council

The collaborative offered stipends to cover registration fees and accommodations for 11 SDUMC teachers and 1 student teacher (who was working with an SDUMC teacher) to attend the 30th Annual Fall Conference of the Southern Section of the California Mathematics Council (CMC) in Long Beach. As part of an effort to involve more teachers in SDUMC activities, the collaborative sponsored only teachers who had not previously received funds to attend a conference. An additional six collaborative teachers attended the conference, but did not receive collaborative funding. The school districts provided substitutes for all teachers who went. The conference, held November 17-18, 1989, focused on the theme, "Building on the *Framework*." Participants had more than 200 sessions and workshops to choose from. After the last session on Friday, collaborative Director Professor Alma Marosz hosted a wine and cheese get-together to provide SDUMC teachers an opportunity to talk with one another and meet some of the people from San Diego who had worked on the conference.

The teachers who were interviewed after the conference felt that the event was very beneficial. One teacher commented, "The collaborative did not pay for any of my registration. My school paid for a substitute. I paid for registration myself. CMC is one of the best conferences. It is better than NCTM. You get more hands-on workshops. At NCTM, you get more of the philosophical approach and little practical materials." A second teacher remarked, "I very much enjoyed what I saw. The alternative assessments workshop was what I wanted and I got to see it. I only went on Saturday, but the sessions I attended on Saturday were very good."

## The Greater San Diego Mathematics Council's Annual Mathematics Conference

The Greater San Diego Mathematics Council's Annual Mathematics Conference was held the first week in February, 1990, at the Old San Diego Convention Center. As in previous years, the collaborative offered to pay the registration fees for all collaborative teachers who wanted to attend the conference. A number of teachers took advantage of this opportunity.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The collaborative and the two school districts sponsored the attendance of 11 teachers to attend the 68th Annual Meeting of the NCTM in Salt Lake City, Utah, April 18-21, 1990. Among the participants was the district mathematics resource teacher, who joined the collaborative staff in May. The collaborative paid the registration fee for the San Diego Unified School District teachers, and the school district paid for travel and hotel. The Sweetwater Union High School District covered expenses of up to $500 per teacher. Both districts provided substitutes to enable the teachers to attend the conference.

The theme of the conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, assembled seeking new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

All of the SDUMC teachers who attended the conference felt that it was worthwhile. One teacher said, "I brought home a mountain of materials [on] cooperative learning [and] motivating students. I plan to use it in the fall after processing." A second teacher remarked, "Strengths were networking with teachers across the country. We learned. A conference weakness was having to have tickets. Bigger rooms are needed for ticket workshops. . ." A third teacher added, "After having been to some of the local ones, CMC-SS and GSDMC are just as well run. People do the same thing everywhere." A fourth teacher noted, "I know one thing, we didn't preregister. We didn't get the workshop we wanted. Having been to the local one, it seems that I had seen a lot of topics. I'm math department chair at my school and the conference will help in developing curriculum." A fifth teacher said, "NCTM conferences are always pretty good. I got into a lot of workshops. I find you have to be persistent. Others didn't wait as I did. There was a good Writing in Math workshop by Grace Burnside. Bruce Hurst did a good workshop on Discrete Math. The workshops put on by EDC were okay. One night this guy spoke too long. Orlando was more exciting." The on-site observer concluded: ". . . the fraternizing among people was good. Even I met some people from other states."

### Communication

During the 1989-90 school year, the collaborative distributed a monthly mailing to all collaborative members to keep them informed about collaborative activities and events. The UMC mailing included minutes of the Executive Committee meeting and announcements of UMC activities, as well as other information that might be of interest to UMC members. Collaborative teachers also received a copy of the CRMSE newsletter, *Quest*.

## E. Observations

### Project Management

The management structure for the San Diego Urban Mathematics Collaborative continued to evolve during 1989-90. Preparing the permanence proposal to submit to the Ford Foundation was a major impetus for the change from a management structure primarily driven by an administrative component to a structure in which teachers are major decision makers. This process required rethinking the collaborative's goals, the roles different groups and people should play, and the collaborative's relationship with the two school districts and others in the community. After four years, the management structure that is in place has the potential to oversee the development of the collaborative well into the future. But as the management of the collaborative reaches some stability there are still questions regarding long term financing, permanent host agency, and expansion that have to be resolved in the near future as Ford Foundation funds are depleted.

In reflecting on the development of the management structure of the San Diego collaborative, it appears that there have been two distinct phases. During the start-up phase, the leadership came from the director and her coordinators. The Executive Committee included teachers concerned about issues, but many of the decisions and much of the direction originated with the director. A number of workshops were conducted, retreats were held, and personal attention was given to individual school mathematics departments in the effort to generate interest in the collaborative. The budget was primarily controlled by the director. During this phase, which involved approximately 150 mathematics teachers from the targeted schools, about 30 became very active in the collaborative. This first phase was successful in launching the project and getting teachers involved. An important factor was the time and energy the director gave to the project and the respect she had within the mathematics education and university communities in San Diego. What did not develop as envisioned was the empowerment of teachers. Teachers were making decisions on the Executive Committee and contributed to the process, but were not initiating programs and taking charge of activities.

The second phase in the development of the management structure evolved in March, 1989, at the Lake Arrowhead retreat. A group of five teachers who had shown particular initiative were asked to meet and develop goals for the collaborative and guidelines for its administrative structure. The planning of this retreat had begun in December, 1988, with a meeting of five teachers and the collaborative director and coordinator. An important reason for increased teacher involvement was the need to submit a permanence proposal to the Ford Foundation by the end of May, 1989. At this point, teachers became more active in planning for the collaborative and assumed greater responsibility for the leadership of the Executive Committee by appointing a teacher as chair. One issue that aroused the teachers when the collaborative's budget was made public was the amount of funding being used to support university personnel. The teachers set the new direction, but questions remained about increasing the involvement of those from the community and doing the strategic planning for the next three years, as required for the proposal. EDC intervened by hiring Arthur Ellis to facilitate community involvement in the planning process and to help structure the administration of the collaborative. This intervention was successful, resulting in (1) the formation of two bodies for guiding the collaborative--the Council of Mathematics Educators and the Board of Directors; (2) the identification of a coordinator/director to help administer the collaborative; and (3) the preparation of a proposal that was approved.

With the advent of the second phase in the collaborative's development, major decision making resided in the Council, which is composed mainly of teachers. The Council gives direction to the coordinator/director. The Board of Directors is to provide advice to the Council and set policy for the collaborative. The Board also provides the collaborative and teachers access to those in business and higher education that was not previously available. A new relationship has emerged between the two school districts and the collaborative. The San Diego Unified School District is supporting the collaborative by providing one of its resource teachers as the half-time coordinator/director; this person is to take direction from a Council of teachers and is to serve teachers both in SDUSD and the Sweetwater Union High School District area. This has required a special commitment on the part of the SDUSD mathematics supervisor, who supervises the resource teacher for the district, and the administration from the Sweetwater Union High School District. People have been able to work out these issues informally so that the coordinator/director is expected to spend time in both districts. In return, there will be times when some activities will be undertaken by people in the SUHSD for the SDUSD. This will also require that the coordinator/director spend time in two offices, at the San Diego Unified School District office and at CRMSE. To support this plan, the former director has agreed to help during the transition.

Other issues face the collaborative as it proceeds through this second phase of its development. During 1989-90, some of the most active teachers spent a tremendous amount of time on collaborative business. These teachers are ready for other teachers to assume more of the responsibility for the collaborative. This will require recruiting teachers who have the interest, time, and skill for such involvement. The development of teacher leadership will be an on-going challenge for the collaborative and is one that still needs to be addressed. A major expenditure of energy in 1989-90 was devoted to planning; less time was given to program development. This was a contributing factor to the low attendance at activities and the cancellation of one event. Another was that the target schools were doing more with their own staff development. One issue facing the collaborative is expanding into other schools. This would increase the cadre of teachers the collaborative could draw from for both leadership and activities. During this expansion, the needs of elementary teachers also are to be considered, particularly if true reform in mathematics education is to evolve within a framework of equity and excellence for all students, which is one goal of the collaborative. The need for expansion is recognized by many of the teachers and others who serve on the Council and the Board.

The second phase in the collaborative's development seems to have set it on more solid footing as a basis for attaining permanent status. This will require that the collaborative have its own source of funding and possibly non-profit organization status. One member on the Board of Directors noted that, due to the interest in science and mathematics in the Greater San Diego area, she is very optimistic that adequate funding could be raised to sustain the collaborative after Ford Foundation support ends. She feels that the collaborative needs to project to the public the long range effects of helping teachers and to remind people that "everybody who becomes anything" has had a teacher. The collaborative also has some plans for hiring an executive director who will be responsible for fund raising. As long as the SDSU serves as the fiscal agent for the collaborative, there is a need for the executive director to be affiliated with the university for purposes of accountability. This can be achieved if the executive director is an adjunct faculty member, but it would require the person in question to meet certain qualifications specified by the university.

The San Diego Urban Mathematics Collaborative made significant strides during the 1989-90 school year in developing a sound administrative structure. The people who were involved in the process were very pleased with the progress made and the collaborative's future promise. The process itself represented true collaboration among teachers, business representatives, higher education representatives, and other community members.

## Collaboration

The progress of collaboration in San Diego has coincided with the evolution of the management structure for the collaborative. In the beginning, the director and coordinators of the collaborative had a major role in decision making and structuring the activities of the collaborative. The overall strategy was to begin with a small group of schools, a high school and two feeder junior high schools, and then expand the number of groups over the years. One goal was to reduce the isolation of mathematics teachers within these targeted schools. Another goal was to have these teachers become more knowledgeable about issues in mathematics education. Teachers at the targeted schools were introduced to the collaborative through visits by either the director or coordinator at school mathematics department meetings. In some schools, the mathematics teachers were not meeting as a group, so the collaborative served as a catalyst to bring them together. The workshops in the first year were generally led by someone from a university.

As the collaborative developed, an increasingly large number of the workshops were led by teachers. Some of the mathematics departments began to meet regularly. Collaborative teachers became more informed about the applications of technology to teaching mathematics, the use of manipulatives in the teaching of mathematics, and other issues being discussed at the national level. Following the 1989 Lake Arrowhead retreat and reform in the administrative structure of the collaborative, teachers became more responsible for designing collaborative activities and began to focus on particular problems such as equity. The collaborative began to be viewed by people in both district administrations as a viable model for professional development, providing teachers an opportunity to take responsibility for their own development. The mathematics supervisor for the SDUSD noted the benefit he has realized by having collaborative teachers use manipulatives, calculators, and other activity-based learning. He uses these as existence models to build a case with other mathematics teachers in the district for the fact that the recommended changes really work. The curriculum director for Sweetwater Union High School District noted that mathematics teachers from collaborative schools have become much better at assuming leadership roles as the district tries to do more with site-based management. At the collaborative schools, there are "already . . . people who have assumed leadership roles in curriculum . . . in the area of mathematics."

Collaboration between the two districts, San Diego Unified School District and Sweetwater Union High School District, increased with the greater effectiveness of the collaborative. Teachers from both of the districts began to share ideas and work together in planning for the collaborative. Collaboration between those in business and industry and the teachers did not really evolve until the Board of Directors was formed--motivated by the requirement for a structure that would increase the probability of the collaborative becoming a permanent organization in the San Diego area. Through contacts made with Board of Directors members from business and industry, some teachers began to use these resources. Those from business and the community are now part of the process of making decisions for the collaborative, addressing issues of funding and showing support for mathematics teachers. One junior high school mathematics teacher, who has been very active in the collaborative, felt that prior to the restructuring of the collaborative, teachers did not have much interaction with members of the business community. Now he feels that teachers and people from business are able to see each other's viewpoints and share mutual recognition of the need for students to be better prepared mathematically. A high school mathematics teacher arranged three visits for her students to businesses, including one to a Navy research laboratory, through a contact made with a researcher who is serving on the Board of Directors. This teacher has expressed an interest in having the collaborative develop a catalogue of similar opportunities that are available to mathematics teachers.

Certain successes have been specifically attributed to the mathematics collaborative. One is that some mathematics departments are now working as cohesive groups. A high school in Sweetwater has seven full-time mathematics teachers and three part-time mathematics teachers. As a result of collaborative initiatives, communication among mathematics teachers at the school has increased, there have been more department meetings, and the group is dealing more with issues. During the intersession of the district's year-around schedule, the department had a week-long inservice. "We see ourselves as a department for the first time . . .," noted a teacher in response to a question about the impact of the collaborative. A principal at a San Diego high school has observed a difference between the mathematics department and departments in other content areas. She noted that the mathematics teachers are being served, they are happy, and they are learning. The collegiality among the mathematics teachers has affected their perception of what can be accomplished. The mathematics teachers "did not seem to get as down as people from other departments . . . ," the principal commented. She went on to say, ". . . quality is better and I see them doing innovative hands-on activities . . . attendance in mathematics classes is stable . . . and that is very good. . . .This department is . . . excellent . . . I have had the least problem with them . . ."

Another outcome is that the mathematics teachers have more knowledge of current trends in mathematics education. The collaborative has given mathematics teachers opportunities to attend workshops and national conferences. These have contributed to an expansion of the knowledge teachers have of mathematics and what mathematics they need to teach. The collaborative has also directed the attention of the teachers to the issue of equity. Over the past ten years the teachers have experienced a change in the increased ethnic enrichment of classes. The district curriculum director for SUHSD sees one spin-off of the collaborative in the fact that mathematics teachers are dealing more with equity in mathematics, as well as with technology, and they are showing greater initiative in assuming leadership.

A third outcome observed by some is the participation of teachers in directing their own professional development. A former school board member for SDUSD, who is now serving on the collaborative's Board of Directors, particularly values the collaborative for its grassroots effort to encourage teachers to become trainers for their peers. She goes on to report, "The collaborative is the only resource that provides the incentive, peer coaching, sharing, opportunities, and influences that are really needed. I don't see anything else out there. The urban mathematics collaborative is the most visible and vital staff development program that exists." An SDUSD mathematics teacher supported the value of having a collaborative, ". . . if it weren't for the collaborative, everybody would probably go on doing their own thing in isolation. . . .There is much more taking place with the collaborative here."

Some problems or difficulties have arisen as a result of the approach to collaboration taken by the SDUMC. One is the time that it has taken to gain the involvement of business. A second has been the expansion of the collaborative to a greater number of schools. The strategy of starting small and then expanding was an advantage because it gave teachers in the targeted schools personal attention. However, the momentum of the expansion was interrupted when a coordinator became ill. One problem with curtailed expansion has been the inability of the collaborative to bring in new teachers to assume leadership responsibilities. What appears to be happening is that some of the most active teachers have become exhausted as a result of the time they have spent working for the collaborative. Another issue is whether those in the area are taking full advantage of the resources available through the collaborative. Even though individual faculty members at San Diego State University have been actively engaged in collaborative activities, none of the three or four proposals submitted by SDSU faculty for Eisenhower funds, which are allocated for higher education, included any involvement with the collaborative. Other collaboratives have found that Eisenhower grants may be a possible source of funding and an opportunity for more collaboration between teachers and those in academic institutions.

The development of a collaborative is a challenge whatever strategy is adopted. The development of the collaborative in San Diego has entailed facing major obstacles. But at the end of the 1989-90 school year, people spoke very highly of what has been accomplished through the collaborative and were excited about its future. There is clear evidence that the San Diego Urban Mathematics Collaborative has brought together teachers, persons from business and higher education, and the school districts' administration to focus on addressing major issues of mathematics education.

### Professionalism

The collaborative has improved the professional climate for mathematics teachers in the targeted schools. In so doing, it has had to confront certain locally significant issues. Mathematics teachers report not having much stature in the San Diego area. One business associate felt that the teachers are so busy working with their students that there has not been time to publicize their effectiveness or improve their image. Another issue for teachers is that of ongoing professional development. One district administrator noted that she and people in business are given professional training during working hours. This is not true for teachers. Low self-esteem and lack of control over career decisions are both aspects of the perception people related to the collaborative have of those in the teaching profession. One teacher's definition of being a professional was "doing something that is valued, that is having a profound effect, and that involves interacting with others in the same field about what you are doing." A collaborative Board member feels that the main attribute of a professional is having control over the decisions that affect your career rather than always being told what to do. A professional also is responsible for outcomes and is trusted by superiors to make decisions and to deliver a product without being told what to do. According to this person, teachers have little control, but the collaborative has provided activities that have helped to empower teachers. A principal noted that teachers are frequently not treated as first-class citizens. She saw this as a contradiction, "If you are asking them to do a first-class job, you had better model that in some way. We do not do that."

The collaborative has made progress towards addressing some of the issues related to the image of teachers as professionals. In one way, the collaborative has provided teachers an opportunity to use their talents in situations outside of the classroom. Having teachers responsible for conducting workshops and doing presentations for other teachers has drawn upon their leadership and organizing qualities to help each other. The collaborative has funded teachers to attend national conferences and has provided opportunities for them to discuss national mathematics education issues, such as the use of technology and the NCTM *Curriculum and Evaluation Standards*. These experiences have increased the self-esteem of mathematics teachers and helped them to feel that they are abreast of the current thinking in their field. Teachers have become less isolated and more inclined to draw upon each other as resources for information. This is a direct result of teachers working more closely with each other within their departments and of teachers getting to know their peers from other schools better.

One of the professionalism issues that has arisen in the collaborative is compensating teachers for their staff development activities. The collaborative generally grants teachers a stipend for attending an event, particularly if held on a weekend. Some of those in the collaborative have noted that people have expressed the opinion that teachers should be willing to attend professional development events to enhance their skills without receiving a stipend. As noted above, one district administrator did not see it this way and felt that more should be done to support the professional development of teachers. She noted that three years before, teachers would not attend curriculum workshops. One reason was that a stipend was not provided. Now that stipends are available, teachers attend. But she did not think this was the sole reason. The mathematics teachers now know what they need to be doing and have reached such a frustration level that they are interested in attending workshops to relieve it. Part of this frustration can be attributed to the fact that teachers have not in the past taught what we are now asking them to teach. Through increased awareness of the issues and knowledge of what is happening in other parts of the country, collaborative teachers see a need to learn new and different ways for teaching. One direction that may be taken to insure that teachers be treated more professionally is to make professional development integral to their work. Until this is the case, it appears that stipends are important in San Diego to prompt teachers to participate in out-of-school activities.

As a result of their collaborative activity, mathematics teachers have assumed more responsibility for their own growth. The collaborative has served to bring people together. This mutual reinforcement has led teachers to feel that they are more respected in the community than in the past and more knowledgeable. The SDUSD mathematics supervisor regarded the fact that teachers have realized the importance of communicating with each other as one of the most important outcomes of the collaborative. After all of the effort that went into restructuring the collaborative as well as into its development from the beginning, it now has a structure in place that will enable it to expand to other schools so that the number of mathematics teachers to gain from its presence can be increased. This will enhance the impact of the collaborative on mathematics education in the two districts.

## Mathematics Focus

The SDUMC derives its mathematics focus from mathematics education reform measures advocated in the California *Framework* and in the NCTM *Standards*. Two major activities during the year, one a workshop on contemporary applied mathematics and another a retreat on technology in the classroom, helped to inform participants of how the world of mathematics and mathematics education is changing and what can be done in the classroom to better prepare students for the world of work. Fifty people discussed a draft of the teaching standards being produced by NCTM to accompany the *Curriculum and Evaluation Standards*. This workshop provided the opportunity for teachers and people from the SDSU to discuss teaching and reflect on what it means to be a professional. In critically analyzing the document, teachers reviewed what it said about the teaching of mathematics and saw that in some cases the techniques described did not match their conceptions of good mathematics instruction.

During the school year, 20 teachers had the opportunity to attend professional conferences outside of the San Diego area. These afforded the teachers additional information on current trends in mathematics and practical examples of presenting mathematical ideas. Fewer activities were conducted during the 1989-90 school year due to the amount of time teachers and others had to devote to planning and preparing the permanence proposal. One scheduled workshop on advanced graphic calculators was canceled.

The planning process has helped collaborative members better understand the direction that the collaborative needs to take. One example is the initiative Lincoln Preparatory High School mathematics teachers took in supporting the establishment of a master's degree program by SDSU and their subsequent participation in the program. One motivation for having teachers at Lincoln work on a master's degree was the need for some form of sustained professional development programming. According to one teacher, a master's degree program will provide ongoing continued education rather than scattered, unrelated workshops; it will require teachers to make a commitment and will provide financial benefits to those who complete the program.

Another strong factor in the influence of mathematics education in the area is the commitment of both school districts in the SDUMC to increasing the quality of the program by raising expectations. As noted in the previous annual report, both districts are moving toward a core curriculum and are phasing out general mathematics. During 1989-90, more emphasis was placed on the use of alternative assessment methods. The SDUSD has decided to change its form of testing and has issued a contract to one of the five major test publishers to assist the district in test development. The mathematics supervisor is reviewing test situations and items as a prelude to developing a test that will conform more to the recommendations in the *Framework*. Tests are being developed for grades 2, 5, and 7. The mathematics supervisor attributes some of his interest in alternative assessment to the interaction he has had with supervisors from the other collaborative districts at the meetings of the UMC mathematics supervisors.

In other assessment-related efforts, the scoring of the open-ended California Assessment Program tasks is used by the supervisor for the professional development of teachers. In Sweetwater, a high school mathematics teacher is doing more with informal assessment by having students on occasion write about how they derived their answers to a problem. The teacher noted that this has given her insight that she had not had before into what students are thinking. A collaborative teacher who attended the Southern Section of the California Mathematics Council's annual conference reported being interested in the alternative assessment workshop that was offered. This concern with alternative assessment indicates that at least some collaborative teachers are interested in one of the major changes the district is attempting to make. By giving teachers financial support to attend conferences, the district is enabling them to learn more about new efforts that support the direction the district is taking.

The SDUMC has realized certain specific outcomes. One is that mathematics teachers who have been active in the collaborative are increasing the use of technology in their teaching and involving their students in a greater number of activities than was previously the case. The collaborative has motivated mathematics teachers to communicate more with each other. This has helped to increase the idea flow among teachers and has given them an opportunity to coordinate what they do in the classroom with what other teachers are doing. The collaborative has helped some teachers to clarify what mathematics is and to become more positive about mathematics. A principal has observed that mathematics teachers have gained the confidence to implement needed changes in the curriculum. Some teachers have emerged as leaders in mathematics education and are taking initiative in dealing with important issues such as equity in mathematics education. The collaborative has helped teachers in the urban schools to benefit from the already very active mathematics community in the Greater San Diego area. As a greater number of mathematics teachers and others work toward reform in mathematics education, one area that needs increased attention is education of the total community about what mathematics is. A collaborative board member points to the fact that many parents view mathematics as adding and dividing and do not have an understanding of mathematical applications. For her, it is important to educate parents along with their children if real changes in mathematics education are to be achieved. The collaborative has made significant differences in mathematics awareness and has energized a core group of mathematics teachers in the two districts. The challenge facing the collaborative is to expand this group by continuing to develop programs that address the magnitude of the reforms needed.

## F. Next Steps

Since achieving permanence in April, the SDUMC has set up a calendar of activities and events beginning in the summer of 1990. During the summer, a Family Mathematics K-8 Workshop (July 5-6, 1990) and an EQUALS Training Workshop (July 9-13, 1990) will be available to collaborative teachers, with the collaborative paying registration fees for member teachers. Other enrichment activities include three miniprojects, K-8 (July 23-27), K-8 (July 30-August 3), and Math A (August 20-24), sponsored by the San Diego Mathematics Project. Each miniproject is scheduled to last for five days during the summer, followed by sessions in the fall and spring. The San Diego Unified School District will pay the $125 registration fee for its teachers, and the collaborative will pay the fee for Sweetwater teachers. Two semester units of college credit will be available for an additional $66.

Three SDUMC teachers will attend the Teacher Leadership Workshop in Durham, New Hampshire, August 4-11, 1990. The UMC Technical Assistance and Outreach Projects have agreed to sponsor one SDUMC teacher and the collaborative will fund the other two. Teachers have been informed of the summer Phillips Exeter Mathematics and Computer Conference in New Hampshire and the Woodrow Wilson Workshop in Los Angeles, as well as a Family Mathematics Inservice at the Lawrence Hall of Science at the University of California-Berkeley. The collaborative Council has recommended that two or three teachers receive collaborative sponsorship for each conference. The collaborative will also fund teachers to attend Assessing Mathematical Understanding, a two-day event sponsored by the Tri-County Mathematics Project at the University of California-Santa Barbara. The workshop will be held October 12-13, 1990, in Goleta, California.

The collaborative has scheduled a Fall Opening Event for October 20 at a local hotel. The event, which will include dinner, is scheduled from 4 to 9 p.m.. Several topics have been suggested that relate to the impact of technology on the mathematics curriculum of the future.

During the 1990-91 school year, the collaborative will be promoting Family Mathematics Workshops for parents whose children attend collaborative schools. The workshops will be district-funded and led by collaborative teachers. The collaborative also plans to offer a workshop on the advanced graphic calculator and extend the opportunity to participate to teachers from five high schools that are being considered for inclusion in the collaborative. The collaborative plans to sponsor another Beginning Graphic Calculator Workshop for collaborative teachers and targeted junior high school teachers. William Wible, the secondary mathematics resource teacher for San Diego City Schools, will be working with the collaborative to enhance and support teaching materials for classroom use.

# SUMMARY REPORT:
# SAN FRANCISCO MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the San Francisco Mathematics Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the San Francisco Education Fund to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts in January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and two site visits by the staff of the Documentation Project.

## San Francisco Mathematics Collaborative

### A. Purpose

The primary goal of the San Francisco Mathematics Collaborative is the development of a network of teachers who are motivated, knowledgeable, and accountable to their colleagues and students and who have opportunities to become the best mathematics educators possible. In achieving this goal, the basic objectives of the San Francisco Mathematics Collaborative are:

1. To create points of intersection for meaningful dialogue among K-12 mathematics teachers, representatives of higher education and local science museums, district administrators, the business community, and other organizations that would benefit from an improved education system in San Francisco.
2. To provide a "safehouse" where teachers can freely express their needs and concerns, share their creativity in open-ended exploratory activities, engage in reflection-oriented activities, take risks, and initiate activities.
3. To provide teachers with opportunities for professional development and collegiality based upon mathematics education.
4. To provide a structure in which teachers can take the lead in the improvement of mathematics teaching and learning.
5. To provide a means by which the community can invest in excellent mathematics education and support teacher ideas that advance quality mathematics education in San Francisco schools.
6. To provide opportunities for teachers to discuss issues of equity as they relate to mathematics education for underrepresented minorities and girls, and to link the activities of the mathematics collaborative to equity issues.

## B. Context

The San Francisco Unified School District (SFUSD) serves the City of San Francisco and the County of San Francisco, a 49-square-mile area with a population of 690,000. Ramon Cortines is the superintendent of schools and has served in that position since 1986; his annual salary is $110,000 and his current contract expires in 1993. During a disagreement with the school board, Mr. Cortines resigned for one day during the 1989-90 school year. There are seven school board members who are elected for four-year terms and receive a monthly salary of $500. Three of the members' terms expire in November, 1990. The Board of Education serves as both a county and a city Board. Therefore, Board meetings begin with a county education agenda and conclude with the city education agenda.

The Board identified education goals for the 1989-90 school year that included raising national test scores for all students in the district and reducing dropout rates while raising attendance rates. School Board members from underrepresented groups have expressed a desire to see the ethnic teaching population and administrative staff, now at 40 percent in the district, increased to reflect the 85 percent ethnic student enrollment. Dr. Robert Harrington of SFUSD's Research and Development Department supplied information on a school-based management pilot program, focused on nine schools, that is scheduled to begin in the fall of 1990. Each building principal was encouraged to use available resources to achieve the established goals within his or her school, but to structure the goals to conform to state and federal guidelines. It is expected that the goals of each school may represent a wide diversity of purposes couched in the language of individual school needs and achieved through the use of a management-by-objectives approach.

Expenditures for the 1989-90 school year were approximately $415,000,000. Federal funds account for 8.1 percent of the expenditures with state contributions at 75 percent, local contributions at 16.6 percent, and other sources accounting for .3 percent. Annual data figures for cost-per-student districtwide were not available. Each school has its own annual costs-per-student figures. For example, Woodrow Wilson High School, with an enrollment of 1,117, expends $5,036.64 annually per student. A $90,000,000 bond measure approved in June, 1988, provided only one-fifth of the $450,000,000 needed to rehabilitate dilapidated schools. A serious fiscal crunch in state education monies halted projected 1990-91 budget presentations for all California schools. The districts' projected school budgets, which would normally have been made public in June, were delayed, awaiting state allocation notification as late as July/August, 1990, before announcing their proposed budgets.

SFUSD has experienced declining high school enrollment but a rising elementary school enrollment, particularly in the immigrant population. Of a 28,759 total elementary enrollment in the 1989-90 school year, 9,700 were Limited English Proficient or Non-English Proficient (LEP/NEP) students. This shift in school population and a need for cost-cutting measures forced the layoff or reassignment of 100 high school teachers in May, 1990. Long-term substitutes (LTSs)--new teachers who fill in for a tenured teacher on leave/sabbatical--hold one-year contracts and are the first to suffer non-renewal. After the release of LTSs, tenured teachers in schools that have classes with a lower teacher/student ratio can be declared surplus and shifted to existing openings in other schools. The latest teacher contract provides an agreement between the Board and the teachers' union on how class ratios are determined. Teachers who can't find an opening are placed in a substitute pool at their regular salary.

Of the total K-12 enrollment of 62,780 in the 1989-90 school year, approximately 18,000 (28.8%) students are LEP/NEP. Ten percent (6,268) of the students have special education needs. Approximately eight percent (5,068) are in the Gifted and Talented program (GATE). Twenty-three thousand two hundred eight (37.1%) are in the optional enrollment program either via attendance permit or inter-district agreement. Approximately 40.4 percent of the students' families receive some form of public assistance: 20,756 (33.1%) students receive free lunch and 4,605 (7.3%) receive reduced-cost lunch.

There are 110 schools in the district: 22 high schools (grades 9-12); 16 middle schools (grades 6-8) and 72 elementary schools (K-5). In 1965, the SFUSD school population topped 100,000 students, but by 1978 had declined to 61,500 students. Between the years 1978 and 1990, enrollments rose and then declined to the approximate levels of those in 1978. During the 1988-89 school year, 17,214 students from within the district's boundaries attended parochial schools and 3,322 attended private schools. According to the SFUSD Research and Development Department, the public schools have garnered a larger percentage of the K-12 enrollment in proportion to private-parochial schools, even though general enrollment figures have declined.

There are 20,211 students in the high schools and approximately 26.5 percent (5,354) are LEP/NEP. Of the students enrolled, 52 percent (10,476) are male and 9,735 (48 percent) are female. The ethnic composition for the high schools is: 52.2 percent Asian; 17.6 percent Spanish-Hispanic; 16.1 percent black; 13.6 percent white; and .5 percent American Indian. Included in the Asian population are several language categories: Vietnamese, Cantonese, Mandarin, Korean, Tagalog, Japanese, and Laotian.

A minimum proficiency testing program in mathematics, language arts, reading and writing is administered in grades 8-12. The tests are administered once during grades 8-11, but three times during the senior year. Students who fail any portion of the examinations are required to attend summer school. In 1988-89, the average scale score in mathematics on the California Assessment Program (CAP) for SFUSD 12th-graders was 264, which placed the students in the 59th position for statewide ranking on a 1-99 scale. Twenty units, or four semesters of mathematics, were required for high school graduation.

Dropout rates in the SFUSD are computed using two methods. The first method is referenced as the cohort study and tracks an incoming freshman class by numerical identity through graduation. Over a four-year period (1985-89), the cohort suffered a 16.4 percent dropout rate, after accounting for student transfers. Out of a 1985 freshman class of 4,760 students, 1,258 transferred and 780 students (or 16.4%) were classified as dropouts by graduation in 1989.

The second method of computing the dropout rate is accomplished by conducting a head count on a monthly basis and then reporting those figures annually. Transfer students who show a gap of more than 45 consecutive days between schools are placed on dropout status. At the conclusion of the 1989-90 school year, the K-12 dropout rate computed by this method was 3.2 percent. The elementary schools had 511 drops for a 1.6 percent rate; middle schools 126 for an .8 percent rate, and high schools 1,612 dropouts for a 6.7 percent rate. A major goal established by the SFUSD is to reduce the dropout rate and to increase the number of days students are in classes.

There are 4,629 teachers in the SFUSD and 869 are identified as high school classroom teachers. Out of 869 teachers, 235 teach mathematics. SFUSD records indicate there are 1,074 permanent certified staff in the high schools and 50 long-term substitutes. Fifty-five percent of the certificated staff is male and 45 percent is female. The teacher ethnic population is: 62.6 percent white; 14 percent Asian; 10.8 percent black; 9 percent Spanish-Hispanic; 1.1 percent American Indian, and 2.5 percent other. The average high school teacher is 50 years old with 19 years of service.

In 1989-90, a minimum salary for a teacher with a BA/BS was $25,715. The maximum was $44,960 for teachers with a Ph.D. or its equivalent--i.e., BA/BS plus 60 credits and 21 years of teaching experience. The average salary is $41,883. Approximately 43 percent of the total number of teachers have advanced degrees and 58.5 percent have some additional credentials.

The teaching contract is for 186 days annually and includes a half day of paid inservice for staff members. The previous teachers' contract expired in September, 1989. Teachers worked through September without a contract and in October, 1989, they approved a new three-year contract that included a seven percent raise over the life of the contract with a provision that the district spend $4 million to reduce class size. That contract will expire in September, 1992. The San Francisco AFT, an affiliate of CFT/AFT, assumed the role of bargaining agent on behalf of the teachers over its counterpart, the San Francisco Classroom Teachers Association (SFCTA). SFCTA had represented the teachers for the past decade. Approximately one-third of the teacher population had belonged to each organization. A surprising number of teachers voted for SFAFT representation in the most recent round of bargaining talks, their reasons for the switch focusing on (1) dissatisfaction with class size (the teachers' most serious problem), (2) a desire for teachers to become more involved in school site decision-making, and (3) lack of action to prevent the district from hiring new teachers as long-term substitutes. During contract negotiations, teachers in nearby San Jose and Sacramento threatened not to return to their classrooms in September, 1989, and the Oakland School District suffered allegations of mismanagement and bankruptcy, thereby causing an unfavorable climate for negotiation talks throughout the Bay area. In October, 1989, SFCTA and SFAFT merged and became the United Educators of San Francisco (UESF). One of the budget problems identified for SFUSD was the fact that county classified employees who work for the SFUSD district received a nine percent pay raise under a separately negotiated county contract, while teachers had previously been held to a 1.5 percent raise for the last several years under the terms of SFUSD negotiations. The SFUSD had to make budget cuts to compensate for the nine percent county classified raise.

In August, 1989, the district released student test scores of the Comprehensive Test of Basic Skills (CTBS) that indicated low scores for certain ethnic groups. This information generated discussion among teachers across the grade levels and established a mandate for considering the issue of equity. A preliminary plan to address the problem was developed by a multiracial team of educators and community leaders, calling for additional teacher training and increased parent outreach. In commenting on the equity issue, Deputy Superintendent Linda Davis expressed the opinion that teacher expectations are not always high enough and students do not always have equal classroom opportunities.

High school mathematics department heads had expressed a desire to use an Algebra Readiness Test developed by the University of California as a placement device for incoming 9th-graders, but the SFUSD Testing Office resisted using the test for that purpose. After a series of meetings between teachers and administrators, the use of the proposed test was approved; the test will be implemented in the spring of 1991. Teachers will receive inservice training to enable them to interpret test data properly and to help middle school staff teachers make informed decisions in their student mathematics recommendations.

In October, 1989, an earthquake, measuring 7.1 on the Richter scale, jolted the city and captured national and worldwide attention. High absenteeism caused by commuting problems at the loss of the Bay Bridge put a major strain on the substitute teaching pool. Many of the teachers who commute from the East Bay were forced to take long circuitous routes to work, a situation that contributed to high teacher burnout symptoms within a short period of time. By November, 1989, the Bay Bridge again opened, easing commuting problems. The offices of the San Francisco Education Fund were relocated as a result of the earthquake.

## Professional Development Opportunities for Teachers

SFUSD teachers of mathematics, K-12, have the opportunity to participate in a variety of staff development programs sponsored by the district and coordinated by the mathematics curriculum office. Eighteen workshops with a total attendance of 1,217 participants were held during the 1989-90 school year. Three series of Saturday workshops (Calculus Institute, Geometry Institute, and Math Their Way) were offered for which teachers either received a cash stipend or a materials stipend. Some teachers were given release time to attend one of seven workshops (Math B, Algebra Institute, Family Math Institute, K-2 Problem Solving, 3-5 Problem Solving, 6-8 Problem Solving, and Bilingual Department Paraprofessionals). Eight workshops were held after school, consisting of Advanced Placement Calculus, mathematics workshops for administrators, a workshop for the bilingual department, Math in Action, Family Math for Parents, a Final Examination Results Analysis for Algebra workshop, Math Their Way Follow-Up, and On-Site Math workshops. These workshops were planned and presented by mathematics teachers who decided on the program and the incentives to be provided for participation. In addition to presenting workshops, the District Mathematics Curriculum Office asked teachers to identify those mathematics education issues that should be addressed by the district. The district supports 24 mentor mathematics teachers who lead and plan programs for other teachers.

Science at the Core is a two-year project to promote science and mathematics instruction at the middle school level, as well as the integration of the two subjects within the curriculum. The project, which began in June, 1988, and concluded in May, 1990, was a three-way cooperative effort of the San Francisco Exploratorium (a hands-on museum of art, science and perception), Lawrence Hall of Science, and the SFUSD. Through the project, teachers had an opportunity to participate in summer workshops and in weekend workshops during the school year that emphasized hands-on activities and cooperative learning. Over 50 teachers representing most middle schools in the SFUSD participated in the program.

The Science, Mathematics and Technology Resource Center, which operates out of the SFUSD Parkside Center, was established in part with a donation from Bechtel Corporation. The Center's goals are to house and distribute materials that support hands-on science and mathematics learning, to promote equality in science and mathematics education, and to provide opportunities for teacher networking. On October 17, 1989, from 4 to 6 p.m., 200 people attended an open house for the Center sponsored by the SFUSD. Twenty-five mathematics, science, and technology organizations from the Bay area, including the San Francisco Mathematics Collaborative, participated in the open house and many set up displays. The open house was interrupted by a devastating earthquake at 5:04 p.m. After the earthquake, the Center did not re-open until November.

The San Francisco Mathematics Teachers of Elementary and Middle Schools (T.E.A.M.) and the San Francisco Mathematics Teachers Association (SFMTA) provide a wide variety of professional opportunities for San Francisco mathematics teachers. SFMTA was founded in 1970 by and for mathematics teachers. It was felt at the time that an organization was needed to bring together people interested in mathematics education in San Francisco to discuss issues, provide activities for teachers and students, and enhance mathematics learning. Each year, the SFMTA holds a birthday party for Euclid; this year it was held May 11 and featured a catered dinner, door prizes, and an opportunity to "Make and Take" a mathematics activity. The association also reinstated its tradition of gathering middle school and high school students together for a fun-filled morning of competitive and non-competitive mathematics activities. The "San Francisco Math In," which was held May 19, was planned by teachers and funded by the district. The Association also publishes a newsletter, *The Exponent*, to keep mathematics teachers abreast of meetings and other professional opportunities, as well as the latest trends in mathematics education. SFMTA actively supports the San Francisco Mathematics Collaborative and its effort to improve mathematics education and to increase professionalism among mathematics teachers. Similarly, the San Francisco Mathematics Teachers of Elementary and Middle Schools has played an important role in developing a high level of interest in mathematics for elementary and middle school teachers in the San Francisco area. To facilitate cooperative planning of professional opportunities for Bay Area mathematics teachers, the collaborative met with representatives of SFMTA and T.E.A.M. in July, 1989, to discuss future cooperative efforts and teacher involvement.

The Interactive Mathematics Project (IMP), a joint project of San Francisco State University, Lawrence Hall of Science, and three school districts (Berkeley Unified, Tracy, and San Francisco Unified), will develop and test three years of secondary school mathematics curriculum in an initiative intended to replace the traditional sequence of courses for the college-bound student. Seven experienced high school teachers will serve as codevelopers, suggesting revisions based on the use of new classroom materials. IMP materials will be introduced through inservice programs conducted by Project EQUALS and the California Mathematics Project, beginning in 1990.

The San Francisco Unified School District is participating in Project 2061, a mathematics and science curriculum development project being sponsored by the

American Association for the Advancement of Science (AAAS). Project 2061, which began in 1985, is a three-phase effort designed to provide a vehicle for a complete transformation of science, mathematics, and technology education before Halley's Comet returns to the earth's vicinity in the year 2061. Bernard Farges, a mathematics teacher and active collaborative participant at Mission High School, codirects the project with science teacher James Knerl. A total of 24 teachers, curriculum specialists, and administrators from the SFUSD are involved in the project. In summer, 1989, project participants spent the entire month of July in Boulder, Colorado, attending lectures and participating in small group discussions on current scientific thought. In summer, 1990, the 24 members of the SFUSD Project 2061 Team will spend six weeks at a national conference at the University of Wisconsin-Madison.

The Summer '90 Institute of the San Francisco Math Leadership Project marks the beginning of the project's seventh year. Pairs of teachers from elementary and middle schools are selected to participate in the three-part development/inservice/outreach program. The year-long activities will include an intensive four-week summer institute (June 25-July 19, 1990) monthly meetings, ongoing classroom support, and reunion activities. Participants present two workshops at their school sites. They also receive a stipend and manipulative materials for their classrooms. Nearly 200 teachers, representing 47 SFUSD schools and 20 other private schools or schools from other districts, have participated in this project since it first began.

Other district activities in mathematics education for 1989-90 are the K-5 Mathematics Specialist Project, funded by the Exxon Corporation and SFUSD. On this project, 3rd-grade teachers field-test innovative mathematics curriculums and K-8 teachers develop model geometry units. Bernard Fargas and Maria Santos were members of the State of California Commission on Teacher Credentials and met regularly during the school year to help develop standards. Two district mathematics teachers, Theresa Hernandez-Heinz and Robin Lou Koto, were members of the California Mathematics Framework Committee and met with others from around the state to develop the third generation of the California's *Mathematics Framework for California Public Schools.*

## C. Development of the Collaborative

The San Francisco Mathematics Collaborative is one of four collaboratives funded through the San Francisco Education Fund (FUND). All four collaboratives--mathematics, science, arts and humanities were managed by Judith Massey Morales, director of Programs and Evaluation through December, 1989. Upon the departure of Ms. Morales from the FUND, Amy Rodriguez-Lee became the contact person between the FUND and the mathematics collaborative. Gladys Thacher, executive director for the FUND, continued to serve as liaison between the collaborative, the Ford Foundation, SFUSD, the donor community, and the FUND Board of Directors. Gretchen Anderson, the FUND's program developer in 1989-90, had responsibility for raising funds for the mathematics collaboratives and other collaboratives supported by the FUND. She worked with the director of programs and the director of development to prepare proposals and reports in support of collaborative funding. In the 1989-90 fiscal year, her position was partially funded by collaborative contributions.

In April, 1989, Lise Dworkin was appointed the full-time director of the mathematics collaborative. This position was jointly funded by the San Francisco Unified School District, as part of its contribution to the collaborative, and the Education Fund. As director, Ms. Dworkin ran the Collaborative Council meetings, orchestrated the programs, oversaw the publicity for events, helped to write proposals for funding, prepared reports to the FUND, and helped the FUND raise money for the collaborative. Because she was also paid by the school district, she participated in district activities such as serving on a program quality review team of one of the schools. For most of the school year, Ms. Dworkin was not assisted by an administrative assistant. Gretchen Anderson served as recorder at Council meetings and prepared the minutes. Toward the end of March, 1990, Robert Driscoll was appointed administrative assistant to the director and filled this position until the end of June. The on-site observer for the 1989-90 school year was Dan Bennett, a mathematics teacher at the International Studies Academy and a Collaborative Council member.

All of the collaborative staff as well as the district's mathematics and science unit coordinator, Maria Santos, shared the same room, a former classroom at the Parkside Center. Ms. Dworkin's and Ms. Santos' close working relationship facilitated the planning and implementation of collaborative events. The June 1990 minutes of the Collaborative

Council described the collaborative and district as partners in co-sponsoring events. Some of the district's budget for the mathematics program helped fund collaborative programs. In this way, the district and the collaborative worked cooperatively, yet the collaborative was not bound by the wishes of the district. However, not all people viewed this close working arrangement as positive. The relationship between the collaborative and district was raised as an issue at the June Council meeting. Some Council members felt that situating the collaborative director in the same room as the district mathematics supervisors compromised the "safehouse" concept. They were concerned that the director might be prohibited from acting in the best interests of the teachers and the collaborative. The Council did not feel strong enough on this issue to institute a change and instead tabled the discussion for a future date.

## The Collaborative Council

The decision-making body for the collaborative, formed in March, 1989, is the Collaborative Council. This group is comprised of 29 members, but only 22 have voting rights. By design, a majority of Council members are teachers. Twelve of the voting members are teachers elected to the Council, four each from elementary, middle, and secondary schools. Two other teachers on the Council are representatives of the mathematics teachers' associations, the San Francisco Mathematics T.E.A.M. and the San Francisco Mathematics Teachers Association. The other Council members are representatives from the SFUSD (one with voting privileges); two representatives from the FUND (one with voting privileges); two representatives from the Exploratorium (one with voting privileges); four representatives from colleges and universities (two with voting privileges); and four representatives from the business community (three with voting privileges). In 1989-90, no one from the Exploratorium and only two persons from the business sector attended Council meetings. Each spring, at least half of the teacher representatives are replaced by other teachers chosen in a district-wide election. In the spring of 1990, over 300 teachers voted in an election to fill seven positions. Fourteen teachers were on the ballot (5 secondary teachers for three positions, 3 middle school teachers for two positions, and 6 elementary teachers for two positions). Council membership can be expanded by a majority vote of the members; in order to maintain the teacher majority, additional teachers will be added as needed.

Council meetings were held monthly from August, 1989, through June, 1990. The meetings were held on different days of the week and at different times of the month. On average, 16 members of the Council attended each meeting. Twenty-four members attended the June meeting, which included both the outgoing and incoming members. A core of about 12 members attended over half of the meetings. This group consisted of representatives from all of the sectors except business; that is, teachers, the district, the two teacher organizations, higher education, and the FUND.

During the year an effort was made to introduce changes in the format of the meeting and in the relationship of the Council meeting to the meetings of the three subcommittees. At the end of the 1988-89 school year, the three subcommittees--Projects, Resources, and Issues--had met on non-Council meeting days; however, this arrangement was too time-consuming. At its September 1989 meeting, the Council decided that the subcommittees should meet on the same day as the Council. The Council was scheduled to meet from 4:00 to 5:00 p.m.; then the committees were to meet from 5:00 to 6:00 p.m., followed by another hour-long meeting of the Council as a whole. This format was used for the October meeting, but did not continue. At the February Council meeting, it was noted that the subcommittees had not met for several months and that they needed to be revitalized, along with the attendance at Council meeting. The meeting format was altered again to permit the subcommittees to meet from 4:15 to 5:15 p.m., followed by the meeting of the full Council from 5:15 to 6:30 p.m. However, this format was never implemented; the remaining four meetings of the year were meetings of the whole Council.

A committee of Council members, appointed at the May 1990 meeting, drafted a statement addressing the structure of the Council. This committee recommended that a teacher chair the Council meetings, rotating every two months, thus freeing the director to be more effective in other areas; that a parliamentarian be appointed and help in the running of the meetings; and that by-laws be written and adopted. This group also recommended that the three standing committees be replaced by ad hoc committees to be formed as needed. These recommendations were approved for trial at the next two meetings, to be held in August and September, 1990.

The director conducted the Council meetings during the 1989-90 school year. The agenda generally included an update on programs that had been offered or will be offered in the future, announcements, discussion of the budget and the allocation of funds, and discussion of issues or other topics pressing at the time. Decisions made by the Council during the year included a vote in September to change the format of the subcommittee meetings; a vote in October to provide for the Projects subcommittee to oversee the planning of the spring conference and to establish as the theme of that conference the NCTM *Curriculum and Evaluation Standards*; a vote in December to send two Council members, the director, and eight teachers to the NCTM annual meeting; a vote in February to reallocate unused travel monies (originally designated to send people to NCTM) to send people to the California Mathematics Council meeting in Asilomar and to change the meeting time of the subcommittees; a vote in March to set the priority of program elements; a vote in April to provide collaborative funds to partly fund the STAMP program; a vote in May to welcome newly elected members at the June meeting; and a vote in June to accept the restructuring committee's report. The program varied for some of the meetings. Teachers who had received collaborative grants to attend the California Mathematics Council meeting in Asilomar gave reports of their experience at the December meeting. In March, following the spring conference, the Council evaluated the conference.

A significant discussion within the Council took place at the April 1990 meeting. In September, 1989, Citicorp had given the collaborative a $50,000 grant that was being used in part to fund the STAMP (Students and Teachers Acquiring Mathematical Power) program at Wilson High School. A teacher raised an issue about the use of $20,000 of this money on the STAMP program. He felt that if the Council was the body responsible for overseeing the expenditure, it should be apprised of how the money was being spent and what the outcomes were. The Citicorp grant had been approved by individual members of the Council in September; the money was received, and then $20,000 allocated to the STAMP program at Wilson High School with very little discussion by the Council regarding how the money should be spent. In raising the issue of this allocation, the teacher was exerting the power of the group and making a statement that the Council should take greater initiative with respect to what the collaborative was doing. In the discussion that followed, members of the Council, including the director of the STAMP Program, who were familiar with the STAMP program and Wilson High School reported on the STAMP program and how the money was being used at Wilson. A FUND representative noted that Wilson's mathematics department had submitted a team grant application to the FUND that built on what was being done at the school through the

STAMP project. After the discussion, the teacher who raised the question initially felt more informed and the group then voted to continue to support the STAMP program as it had been doing.

The San Francisco Education Fund engaged Harder and Kibbe Research and Consulting to do an evaluation of the four collaboratives that were to be coordinated through the FUND. A representative from the research firm attended the April 1990 mathematics Collaborative Council meeting and asked those present a number of questions. In December, 1989, Harder and Kibbe submitted to the FUND a paper entitled, "The Collaborative Process in Education: A Review of the Literature." This was a draft document describing the literature on collaboration. Twenty-seven references were listed in the bibliography. In June, the firm submitted a summary of responses collected from collaborative participants through focus groups and a survey. The responses were grouped under six categories: motivation to participate, gaps, the role of the FUND, role of the district, the goal of the mathematics collaborative, and the future. Eleven teachers and one business partner associated with the mathematics collaborative responded to the survey. Teachers indicated that their participation in the collaborative has given them exposure to new ideas, a different view of mathematics, and a better working relationship with other teachers.

Of those who responded to the questionnaire from the mathematics collaborative, six indicated that the collaborative had met their expectations to a great extent and six said that it had somewhat met their expectations. To the question about the extent to which the collaborative had affected their classroom teaching, four responded that it had a great effect; three, somewhat of an effect; three, little effect at present, but they expected it would in the future; and one indicated that it had had little effect with no expectation of future effect. A variety of responses were received on other questions; however, in general the responses were very favorable to the collaborative.

At the May meeting, the director explained that the workshop on the highlights of the NCTM Annual Meeting was canceled because of low registration--only 10 people had signed up to hear 7 speakers. This action disturbed Council members who felt that the event should not have been canceled, regardless of the number who had registered. A discussion ensued on how to get people, including Council members, to register for events.

Suggestions were offered, but no definitive decision was made regarding possible ways to rectify the problem of pre-registration for events.

During this first year of the Council, a transformation has taken place in how teachers view their role. When the Council was formed in March, 1989, teachers were asked to volunteer to serve as chairs. No one did, so the director assumed this position. During the middle of the year, some teachers became increasingly displeased with their role on the Council. This displeasure eventually culminated in strong opinions being expressed at the April and May meetings and the formation of the group to redefine the structure of the Council's operations. However, by the end of the school year, some of the teachers who had been the most vocal in expressing their displeasure decided to continue their service on the Council and build on what had been accomplished.

At the June meeting, some evolutionary steps were taken. The recommendations of the restructuring committee were approved. Also, time was spent orienting the newly elected Council members to the history of the collaborative and the activities of the Council. This had not taken place for the first group of teachers. The teachers who had not been a part of the collaborative prior to being elected to the Council in 1989 were given materials to read, but they were not really given much explanation as to what the collaborative was. One teacher in this first group commented that it took about six months for her to feel as if she knew enough to actually participate in the meetings.

### Council Subcommittees

As noted above, the three subcommittees--Projects, Resources, and Issues--met only a few times during the year, generally in coordination with a Council meeting. Most of the business of the Council was done by the committee-as-a-whole or by ad hoc groups formed to do specific tasks. For example, individuals were designated to plan the spring conference. Lise Dworkin chaired the planning group and was assisted by Marilyn Noda Swartz, the cochair representing the SFMTA, and Delia Levine, the cochair representing the San Francisco Math T.E.A.M. Many others served on the spring conference committees responsible for workshops, parking and security, registration, the publicity flyer, hospitality, site and equipment, evaluation, packets, door prizes, program printing, videos, and reproducing materials. These groups generally worked independently of each other. At the end of the year, the standing committees were felt to be unnecessary for the operation of the collaborative and were formally disbanded.

### K-12 Expansion

In developing its permanence proposal the San Francisco Mathematics Collaborative decided to expand its targeted teacher group and program to all K-12 mathematics teachers in the district. This increased the number of teachers who were eligible to participate from under 300 secondary mathematics teachers to a total of about 1,500 districtwide. Active steps taken by the collaborative to further this expansion included electing an equal number of teachers from each of the grade levels to serve on the Council, having programs that would appeal to teachers from a range of grade levels, planning the spring conference to include secondary teachers as well as elementary teachers, and creating triads of teachers with one from each grade range. Some problems arose during the year in conjunction with this expansion. For example, the director had difficulty trying to find speakers who would appeal to teachers from a range of grade levels. One program that met with some success featured Dr. Randall Charles from California State University at San Jose who spoke on problem solving.

The collaborative engaged in a number of activities during the school year to increase the interaction of teachers from all grade levels. The Council membership was redefined to include equal representation from elementary, middle, and high school teachers. The spring conference, planned and conducted by teachers, was designed so that teachers from different grade levels served on committees and worked together on the program. Triads of one teacher from each grade range (elementary, middle, and secondary) were formed as part of the Cross-Grade Visitation Program. Special care was given to ensure that elementary teachers received grants to attend the Asilomar mathematics conference.

Important progress was made in getting teachers from across the grades to begin working together, but more time is needed before the collaborative can truly say K-12 teachers are working as a unified whole. Elementary teachers were very interested in participating in programs and attending conferences, partly because a group of them have become very active in the California Mathematics Project's San Francisco Mathematics Leadership Project, directed by Dr. Carol Langbort at San Francisco State University. The collaborative has begun to serve the purpose of bringing this and other elementary teacher groups together with the secondary teachers. The director feels, however, that it may take another four or five years before the collaborative is truly integrated across grade levels.

## D. Project Activities

During the 1989-90 school year, the San Francisco Mathematics Collaborative sponsored a variety of activities for teachers of mathematics in grades K-12. The activities were designed to enable teachers to establish networks with their peers and with other professionals and to increase their awareness of the changes in the world of mathematics and its applications. The collaborative also supported teachers' participation in activities sponsored by the San Francisco Mathematics Teachers Association, the San Francisco Unified School District, and other Bay Area institutions by publicizing the events and, in some cases, providing funds to support the participation of teachers.

### K-12 Kick-Off

The collaborative sponsored a K-12 Kick-Off on October 4, 1989, from 4 to 6:30 p.m. at the Seven Hills Center at San Francisco State University. The event, which was attended by approximately 130 teachers, was designed to bring together teachers from every grade level and to publicize the collaborative's transition to a K-12 organization. The evening began with hors d'oeuvres and an icebreaking activity that required teachers to approach a teacher from each level (K-1, 6-8, and 9-12) and ask each to describe his or her favorite mathematics topic to teach. The icebreaker was very successful in getting teachers from across grade levels to engage each other in conversation. Collaborative Director Lise Dworkin then introduced herself and the members of the Collaborative Council, and spoke for a few minutes about the collaborative. The keynote address was delivered by Dr. Randall Charles, professor of Mathematics Education at San Jose State University, who spoke on "Building a Developmental and Comprehensive Problem-Solving Program for the '90s." Dr. Charles addressed problem solving at all grade levels. Following Dr. Charles' presentation, teachers were encouraged to sign up for newly initiated collaborative programs, including a cross-grade classroom visitation program for elementary, middle, and high school teachers and the "Math Buddy Network," in which a teacher is paired with one or more mathematics teachers at other grade levels so that the teacher has a source of information and support at these levels.

Overall, the event was very successful. There was an equal representation of K-8 and 9-12 teachers, providing teachers at all grade levels with the opportunity to network with one another. The written evaluation forms indicated that teachers felt that the speaker was knowledgeable and the topic of the talk relevant, with the former receiving a score of 4.2 and the latter receiving a score of 4.03 on a scale of 1-5--with 5 representing high approval. The 82 teachers who completed the forms rated the opportunity to interact with other mathematics teachers as a 3.92. The teachers who were interviewed by the on-site observer, however, were not all quite as positive in their evaluations. One middle school teacher commented, "He [Randall Charles] really did a good job of presenting something for everyone. It's a real tight-wire act trying to please elementary and high school teachers, but we all teach problem-solving, right? It was a good mix." A high school department head added, "I thought he was good. He did a good job, considering the mix of people he was addressing. The food was good. I enjoyed meeting all these new teachers. But you know, I kind of missed the feeling of us all being high school teachers--when we all sort of knew each other. I know it's important to open up to include everybody, but you wonder if the scope is going to be too wide." An elementary teacher said, "It was all right. I've heard it all before. The food was good." Another elementary teacher added, "I thought it was great. You folks don't kid around when you say 'hors d'oeuvres'. I'll be able to use a lot of this stuff.

**Workshop Series on the Hewlett-Packard Graphing Calculator**

The collaborative sponsored a series of four workshops on the HP28S graphing calculator and symbol manipulator. The HP28S calculator represents some of the latest in calculator technology, since it can create graphs and also manipulate symbols for solving problems in algebra and calculus. The collaborative sponsored the workshop series in order to train teachers on the use of the calculator, since it was felt that this advanced technology may well have an impact on how mathematics is taught.

The workshops were led by Millianne Lehman, a mathematics professor at the University of San Francisco, who donated her services to the collaborative. The

University of San Francisco provided the space for the workshops as well as light refreshments at the beginning of each session. Each teacher who participated received an HP28S calculator, valued at more than $200, donated by Hewlett-Packard. The workshops were held after school, from 4 to 7 p.m. on September 27, October 11, November 8, and November 29, 1989.

All high school mathematics teachers were invited to apply to attend the workshops, but teachers had to register in pairs and enrollment was limited to 20 teachers. The criteria used to select the participants from among the 50 applicants included (l) selecting teams so that as many different high schools as possible would be represented and (2) choosing teams of teachers who were teaching advanced mathematics courses, since it was assumed that the technology would first be applied in those classes. Even given this selection process, teachers with a wide range of calculator experiences participated. As a consequence, teachers varied in the amount of time they needed to become functional users of the calculator.

Overall, the four workshop sessions went well, although the teachers had to work very hard and were sometimes frustrated. Initially, many of the participants appeared to find the calculator difficult to use. After the first workshop, the on-site observer reported, "Complaints about the difficulty of using the calculator were common, but I don't think people were discouraged. I think everyone sensed they were dealing with a very powerful and useful tool, and were excited to have one and learn more about it. Everyone thought Millianne's problem-solving approach to her presentation was clear and motivating." By the October workshop, teachers were beginning to feel comfortable with the calculators and several had began to use them in their classes. The on-site observer commented, "Teachers obviously felt more at home with the calculators and could imagine using them in the classroom. Several teachers reported 'blowing away' their students by being able to perform complex operations like multiplying matrices as quickly as they could write them down. The activities are becoming more interesting and less frustrating. I think everyone is enjoying the workshop and Millie's presentation."

The teachers worked more independently during the third and fourth workshops, with a great deal of time being allocated for the participants to key programs into the calculator. This seemed to cause some of the participants a little frustration. After the final workshop, the on-site observer said, "I felt the workshops began to lose steam in the last two sessions, where most of our time was spent keying in programs. This is due in part to people being on different levels and having varying degrees of success in making their programs work. This made it difficult for the group to work together on interesting problems or applications for the calculator. Keying in programs could have been given as homework, but not having Millie around when things went wrong may have presented difficulties. People seemed very grateful to have the calculators given to them and everyone was impressed by Millie's teaching. I think most people experienced some frustration keying in programs they didn't understand."

In their final evaluations of the workshop series, teachers praised the workshop, expressed appreciation for having received the calculator, and spoke of integrating the calculator into their classroom teaching. Many of the participants seemed to feel that they still needed further practice in order to fully utilize the powerful calculator. One teacher commented, "Workshop was great. I really enjoyed learning to use the HP. Millie's directions were clear and the lessons she presented were clear and very diversified. I sometimes got frustrated when I ran into errors on my machine. Once those were corrected, I could go on. I shall hope to have more time this summer to work on the HP. I very much appreciate having the HP given to us so we can use it in our classrooms and practice during the summer." Another teacher said, "This workshop has been very instructional and informative. The opportunity to integrate knowledge and experience with teachers from other schools is commendable. The HP28S ability to handle math concepts from basic algebra to calculus is a blessing to all math teachers. The professor has been exceptionally patient in her presentation and in her demonstration of problem solving. It is one of the best workshops I have attended this school year. The efforts and energy devoted to this workshop for the teachers are much appreciated." A third teacher reported, "The first sessions were extremely organized. I was able to go home and practice. The second two sessions were rushed--people were not together and I spent a lot of time waiting for help--I will definitely need more help as I am somewhat lost . . . . more follow-up sessions would be helpful as when I run into problems, I doubt that I'll be able to see my way out on my own. Some of us have very little computer expertise and a lot of it may as well have been magic--I don't feel as if I'm 'on top' of this incredible machine." A fourth teacher remarked, "Thanks for the great workshop. I've learned a lot but need to learn much more about the HP28S. The instruction was clear and usually easy to understand. I appreciate receiving the calculator though it gives me a headache after three hours because of the small screen. The handouts are good. Now I have to sit down and really try to digest it all. I'm already using some of what I've learned in the classroom." A fifth teacher stated, "I learned a lot in terms of how to graph functions. Graphing functions proved very helpful in the classroom. I have demonstrated graphs in the class. Ms. Lehmann has been very helpful and patient. I needed more classtime to understand why the programs work. For example, keying in the programs took time, but I would have appreciated [knowing] what I was keying in. It was a pleasure meeting other people from the other schools. I liked the light refreshments." A sixth teacher said, "Was a great workshop! Really enjoyed learning how to use the HP; had thought about purchasing one in the past but was intimidated by all the procedures. Now I not only own a calculator but am able to use it. Millie was a great instructor! Knows the calculator inside and out and had wonderful examples to assist us in applying it in our classrooms. Thank you very much! A 10!"

### City College of San Francisco Workshops

#### Probing the Primes and Counting, Probability and Pascal's Triangle

The collaborative sponsored a workshop for teachers of grades 4-6 on Saturday, October 14, 1989, from 9 a.m. to noon, at San Francisco City College. The workshop, "Probing the Primes and Counting, Probability and Pascal's Triangle," was designed to address several of the topics that are emphasized in the NCTM *Standards*. Leon Luey, City College of San Francisco, explored prime numbers and also presented problems that involved counting, permutations, probability, and Pascal's triangle.

All K-12 mathematics teachers were invited to the workshop, which was held at the City College of San Francisco. The event was publicized as being targeted for teachers of grades 4-6 in order to attract both elementary and middle school teachers. Ten teachers originally registered for the workshop, but only four attended; three teachers had canceled and three did not show up. The poor attendance was attributed to the fact that there were conflicting events on that day. It was also suggested that the workshop topic may have seemed intimidating to elementary school teachers. The on-site observer was unable to attend, but the collaborative director reported that the teachers seemed enthusiastically involved in the activities and looked as if they were enjoying learning some new mathematics.

## Topics in Discrete Mathematics for Middle School

The collaborative sponsored the workshop, "Topics in Discrete Mathematics for Middle School," for teachers of grades 5-9 on Saturday, November 18, 1989, from 9:00 a.m. to noon. The workshop, which was held at San Francisco City College, was designed to focus on topics that are to receive increased emphasis according to the NCTM *Standards*. In his presentation, Thomas Walsh of City College explored activities involving logic, counting, and graph theory.

All K-12 teachers of mathematics were invited to attend the workshop. The workshop was publicized as being targeted for teachers of grades 5-9 in order to encourage both middle school and high school teachers to participate; however, of the seven teachers who attended, six were middle school teachers and the seventh, the only high school teacher, was the on-site observer. Fifteen teachers had originally registered, but several canceled and a few simply did not show up.

The teachers appeared to have found the workshop worthwhile, and a few reported that they could see some immediate applications to their classroom teaching. One teacher commented, "Well, guess it's time to go home and rewrite my curriculum again. I'm always looking for new things to try. I definitely want to try those activities with traveling networks and the graphs games with my 8th-grade honors students." A second teacher remarked, "I really thought it was great. I'll be able to use some of the materials, not all of it. I like that he opened with a quote (from Polya) about knowing more than what you teach. A lot of this stuff I enjoyed just learning myself. It makes me feel better prepared as a teacher. He's a great teacher--really interesting and funny. These workshops make me want to take more courses at City and really strengthen my math background." A third teacher added, "I wish we'd spent more of the time actually doing some of the activities. I know I won't try something with my students unless I've done it myself. I don't think most of my students can handle these concepts. In the future I'd like to get more things I can take right back to the classroom." The on-site observer said, "I thought the presentation was excellent. Tom obviously spent a great deal of time preparing a wide variety of materials that gave a good overview of the breadth of the topic. He included copies of a selection from the NCTM *Standards* along with numerous classroom-ready materials and other materials to enrich the teachers' understanding of discrete math. It's too bad more people weren't there, though the small number made it easy to interact." The low attendance at the workshops may have been related to the lack of an incentive to attend. The Council discussed providing a stipend or some other incentive for such future workshops. No firm decision was made.

## Developing Number Sense in Upper Elementary Students

The collaborative sponsored a two-part workshop on using mental imagery and manipulatives to develop students' number sense. The first session, Saturday, May 5, 1990, focused on whole numbers, while the second session, Saturday, May 12, focused on fractions. Both sessions were held from 9:30 to 11:30 a.m. at the Parkside Center of the San Francisco Unified School District. Collaborative Director Lise Dworkin presented the workshops. During the sessions she demonstrated mental computation and estimation processes that promote types of thinking that can be used as alternatives to paper-and-pencil procedures. She also discussed current research on promoting underlying number concepts.

The sessions were targeted for teachers of grades 3-5. Attendance at the workshop was high, with 28 teachers (averaging 13 years of teaching) attending the first session and 27 teachers attending the second session. Each of the 27 teachers who attended both sessions received a $75 stipend from the school district to purchase mathematics materials.

The teachers' reactions to the workshops were extremely favorable. The 28 teachers who attended the May 5 workshop rated the Content of the Presentation an average of 4.5 (on a scale of 1-5, with 5 being the highest). Usefulness of the Workshop was rated 4.6 and Presenters' Organization 4.7. Written comments by the teachers indicated that they felt that they would be able to apply what had been presented at the workshop in their classrooms. Comment included: "I will be able to implement the ideas right away. Everything was helpful to various grade levels. Information was not new, but it was presented in a different way!" "It will change considerably my presentation of activities on number problems (numeration)." "New ideas. Practical, useable ones with immediate implementation." "The workshop was helpful in pointing out the importance of using judgments in math instead of depending solely on algorithms." "I've been waiting for someone to come up with strategies for teaching numbers for some time now, and the extended ideas and techniques are very, very helpful. Thank you." And finally, "The workshop presented and stimulated many new ideas which are very applicable to my classroom situation and grade level."

The teachers gave an even higher rating to the May 12 workshop. The average rating by the 24 teachers who completed the written evaluation forms was 4.9 for Content of the Presentation and 5.0 for both Usefulness of the Workshop and Presenter's Organization. Teachers also praised the workshop in their written comments. Among the comments were: "I'll be able to use these ideas and expand mental math with my students. Thank you for the wonderful ideas." "I just think overall the workshop is interesting and highly informative. Thanks!" "It has given me concrete ways to teach estimation and mental computation." "[The workshop] . . . validated my approach to teaching facts and encouraged me to do more mental math development." And, "Thanks for explaining the requirements or definition of when a student is on the way to developing a number sense. This was a wonderful workshop." The director commented that she enjoyed presenting the workshops and felt they helped upper elementary teachers view the collaborative as an organization with something to offer them.

### The Mathematics Education Reform Movement: New Directions for Mathematics Teaching in the 90s

The collaborative, with funding from Citicorp, sponsored a series of three after-school workshops on important issues and ideas associated with the national mathematics education reform movement. Each of the three workshops, which were held at the Seven Hills Center of San Francisco State University, featured a noted leader of the reform movement. The series was open to all K-12 teachers of mathematics. There was no fee for attending, although pre-registration was required for each of the three workshops. The workshops were held from 4:30 to 6:30 p.m. and complimentary refreshments were served at a social hour at the beginning of each workshop.

## "Untracking the Curriculum Allows You to Untrack Students"

The first workshop in the Mathematics Reform Movement series, held February 8, 1990, featured Sherry Fraser of the EQUALS Project at the Lawrence Hall of Science. In her presentation, Ms. Fraser addressed the issue of untracking the mathematics curriculum and the positive student outcomes that resulted. She described the Interactive Mathematics Project [IMP], which is a problem-based curriculum project designed to replace the traditional college-preparatory sequence. Mission High School in San Francisco and Berkeley High School began the IMP this year with 9th-graders of various ability levels, who would have been assigned to courses from general mathematics to algebra. Ms. Fraser discussed the project's progress, gave examples of activities and of students' work, and shared testimonials from the class.

Nearly 60 people attended the workshop, including 19 teachers of grades K-5, 10 teachers of grades 6-8, 25 teachers of grades 9-12 (including several from Mission High School), 1 representative from business and 2 from higher education, a district curriculum leader, and the collaborative director.

The participants seemed to be very interested in the speaker's message, although several appeared skeptical about the pilot curriculum. One teacher commented, "It was inspiring. I'd really like to visit her class and see what it's like. It sounds like a great class--the kids are doing amazing things, at least the ones whose work we saw. This was a good talk--one of the best. The hors d'oeuvres were good too, though kind of high calorie." A second teacher said, "I thought it was interesting. I thought she made some good points about what mathematics is--the study of patterns and so on. Challenging us to think about what math is. I wish she would have had more examples of student work from other schools. I wonder if it's as successful at Mission as she says it is at Berkeley. The food here is always good." A third teacher remarked, "I don't know, I'm kind of skeptical. How much math are they really learning? I mean all that stuff is really time-consuming. How much math can they learn when they spend all that time reading, 'The Pit and the Pendulum,' or doing experiments? I'm glad I came. It's interesting to hear people's ideas, but I am pretty skeptical. She didn't say anything about how it's working at Mission." A fourth teacher noted, "This sort of class intrigues me. It seems pie in the sky--but glorious. It is hope for the future. I wish I were involved." The on-site observer reported, "I found the talk inspiring, though I shared some teachers' skepticism. Several teachers mentioned they wondered about Mission. I hope to visit classes and find out more for myself. The comments of the teachers are pretty typical. I was sitting next to teacher number three and watched him move from skepticism that bordered on hostility to healthy skepticism mixed with genuine interest by the time I interviewed him after the event. The talk really seemed to open his mind to the idea of someone (not him) trying something radical in curriculum reform."

## Realistic Assessment in Mathematics: Alternative Methods

The second after-school workshop in the Mathematics Education Reform series was held Wednesday, March 28, 1990. Phillip Daro, Director of the California Mathematics Project, was the guest speaker. Mr. Daro's talk focused on new types of assessment techniques for mathematics that promote learning and reflect the reform goals of mathematics education. Each participant received a copy of the booklet *Assessment Alternatives in Mathematics* published by EQUALS and the California Mathematics Council.

The workshop was attended by 58 people, including 15 teachers of grades K-5, 9 middle school teachers, 24 high school teachers, 5 representatives from higher education, 3 school district administrators, a representative from the San Francisco Education Fund, and the collaborative director.

Responses to Mr. Daro's talk were generally positive, although several teachers expressed skepticism about implementation. A high school teacher said, "The topic intimidated and intrigued me but the lecture did not make me feel inadequate and antediluvian; rather, hopeful and somewhat empowered to enact the ideas. It was a better than usual presentation with activities that really worked." A K-5 teacher remarked, "The portfolio approach (to evaluation) needs to be related to realities in the district, like report cards, communicating with parents, and teacher evaluation as well." Another K-5 teacher said, "These are some of the most valuable get-togethers I have found to stretch (and strengthen) my brain." A middle school teacher commented, "Great food. Receptive and interested teachers. I really liked the cross-grade sharing. I wish we had more time for questions at the end. Where can we see it in action? Are there any videos, or schools that can present?" A high school teacher added, "I would have liked to see some of the techniques used; the talk was kind of boring." A representative from higher education said, "There should have been more time for questions. For example, how is this to be implemented and how will the implementation be evaluated?" The on-site observer reported, "Food was good and time to mingle was valuable. The talk was well-prepared and interesting--thought provoking."

### "The Mathematics Education Reform Movement and the New California State Framework for Mathematics" Workshop

Approximately 50 people attended the workshop, "The Mathematics Education Reform Movement and the New California State Framework for Mathematics," the final workshop in the three-part series. The participants included 8 elementary school teachers, 9 middle school teachers, 27 high school teachers, 5 representatives from higher education, and 2 representatives from the school district. The workshop, held May 1, 1990, featured Professor Alan Schoenfeld of the School of Education at the University of California-Berkeley. Dr. Schoenfeld's presentation focused on the changes educators envision in developing students' mathematical thinking and the intended role of the new draft of the *Mathematics Framework for California Public Schools* in responding to that vision.

Dr. Schoenfeld's presentation stirred people's thinking about mathematics reform. Some felt his talk was the most enlightening in the series of three presentations because it put the concern with reform in context. On the evaluation form, participants were asked to rate statements about the presentation on a five-point scale (5 the highest rating). The average ratings on the five statements about the value of the presentation averaged over 4.0. The average rating on the statement, "The speaker stimulated my thinking about the topic/issues," was 4.11. Of the fourteen written comments on the evaluation forms, 8 (57 percent) were positive and 5 (36%) were neutral or did not apply to the presentations. Only one comment was negative.

Teachers interviewed by the on-site observer indicated that some people felt the political realities of reform will be a challenge. One teacher remarked, "Maybe he's a realist but it sure is a downbeat way to finish a series--we hear two people talk about exciting things happening in the reform movement, then this guy tells us why the movement is doomed to failure. I guess that's a little strong but he did give the impression that the *Framework* was going to be sabotaged by [California Superintendent Bill] Honig." A second teacher added, "I thought the other talks were better. They were more inspiring. He (Schoenfeld) was more negative--like the reform movement is going to be stalled by the politicians and we're helpless to do anything about it. I think his focus should have been on the content of the *Framework*." A third teacher commented, "I thought it was kind of boring. I like the talks that involve the audience more, like last time when Daro got teachers working on a problem in groups. I would have liked to hear more detail about the *Framework* and how it's going to be implemented. It sounds pretty radical and these people tell us how great it is, but we don't get too many specifics."

### Woodrow Wilson 1989 Summer Institute and Follow-Up Workshop

The collaborative and the Woodrow Wilson Fellowship Foundation cosponsored a Woodrow Wilson Summer Institute, "Functions 2," August 14-18, 1989. The Institute focused on using technology to teach functions and problem solving. Teachers were encouraged to bring a copy of the NCTM *Curriculum and Evaluation Standards* and a copy of *Everybody Counts* (MSEB, 1989) with them to class, as well as a summary of a classroom activity that uses calculators or computers to introduce a new concept, and a blank disk. The Institute, held at the Parkside Center of the SFUSD, was scheduled from 8:30 a.m. to 4:30 p.m. each day. Lunch was provided and on Thursday, a dinner reception was held from 4:30 to 6:00 p.m. for participants and presenters. All high school mathematics teachers in San Francisco were invited to participate in the Institute; 25 collaborative teachers and the collaborative director attended. Thirty-five teachers had enrolled, but several canceled. The collaborative paid the registration fee for the 27 participants. The participants were also eligible to receive either district Professional Growth Units or two units of upper division undergraduate credit from San Francisco State University. (Teachers had to pay $60 for the university credits.) In addition, the SFUSD awarded each participant $300 to buy mathematics materials.

The participants had mixed reactions to the Institute, which perhaps could be attributed to their varying levels of experience. One teacher commented, "Some of us were having a hard time keeping up with what was going on. I think we could have used more time to practice using those things (calculators); we'd certainly need to understand them better before we could start using them with our students." Another teacher said, "I've been to two other Woodrow Wilson Institutes and the others were really super. This one was sort of 'eh'. These presenters aren't as dynamic as others, and there's not as much hands-on stuff to do. Maybe it's because I already know all this stuff. I learned more new stuff at the Statistics Workshop." A third teacher remarked, "I get really bored when they just lecture. I'm really surprised they don't do some group work or engage us more in actively participating. These calculators are really neat, but I have a hard time paying attention to the presenters. I'd rather just play with the calculator." A fourth teacher stated, "These calculators are really great. If students had these things in their hands, it would really revolutionize how we teach. I really like the materials they've assembled for the workshop." The on-site observer reported, ". . . I was knocked out by the calculators but less than inspired by some of the software. It surprised me that there wasn't more focus on pedagogy. New tools are going to call for new methods, and the presenters neither addressed them, nor (in some cases) modeled good teaching methods, such as group work. The materials assembled were outstanding, and I learned a lot."

Six months after the Institute, the Woodrow Wilson Fellowship Foundation conducted a survey of all participants in its 1989 one-week summer institutes. Thirteen of the participants in San Francisco's August 1989 Institute wrote comments. Four felt that the Institute was not as useful because of the way it was presented--too much material for the time allotted, not enriching, dull sessions, and too much technological wizardry. However, two of the teachers indicated that they were using the graphing calculator in their classroom because of the Institute. The remaining nine teachers who responded all indicated that the Institute had either affected what they do in their classrooms or in their professional lives. For example, one teacher who has become more aware of new technology is doing less with drill and practice problems. Another teacher gave the Institute credit for motivating him to work intensively on curriculum projects such as Project 2061. Although the one-week Institute was not well received by at least 15 percent of those who attended, many of the participants felt that they had benefited from it. Over one-third of the teachers, queried six months later, reported positive changes as a result of attending the Institute.

## February 3 Follow-Up Workshop

A follow-up session for participants who attended the Summer Institute was held at the Parkside Center on Saturday, February 3, from 9 a.m. to 2 p.m. The workshop, which was led by Woodrow Wilson Institute Team Leader Fred Wright of Seattle, Washington, provided an opportunity for teachers to discuss successes and difficulties they have had in implementing what they had learned at the Institute. Participants were asked to come prepared to share ideas that they had tried in their classrooms.

While participants had been encouraged to each bring a "math friend" to the workshop, a total of only seven people attended. The collaborative director reported that those who did attend enjoyed the session and especially appreciated the opportunity to share ideas and talk about their teaching experiences, although they were not all related to the Institute.

## 1990 San Francisco K-12 Spring Mathematics Conference

The second annual Spring Mathematics Conference was held after school on Wednesday, March 7, 1990, at Benjamin Franklin Middle School. The Conference, which was funded by Citicorp/Citibank, focused on the NCTM *Standards*. It was sponsored by all of the professional mathematics organizations in San Francisco, including the collaborative, the San Francisco Teachers of Elementary and Middle Schools (T.E.A.M.), the San Francisco Mathematics Teachers Association, and the San Francisco Math Leadership (part of the California Mathematics Project). The Conference, a major collaborative event, marked the first time that all of the mathematics organizations have worked together to sponsor a program. A large number of volunteers, nearly 80, worked to plan the Conference and present workshops. Seventeen different subcommittees were formed to handle various aspects of the event.

The K-12 Mathematics Conference featured 31 workshops, a keynote speaker, a Mathematics Fair, and a reception with refreshments and door prizes. The Conference began with registration from 3:30 to 4:10 p.m. Between 4:10 and 5:00 p.m. and 5:10 and 6:00 p.m., local teachers and representatives from higher education presented 31 50-minute sessions. Workshop topics highlighted themes from the NCTM *Standards*, and all participants were given copies of the Executive Summary of the *Standards*. A Mathematics Fair, with dozens of booths displaying curriculum ideas and videos, ran concurrently with the workshops. At 6:10 p.m., participants heard keynote speaker Ruth Cossey of the EQUALS project at the Lawrence Hall of Science and co-author of *Family Math*. Ms. Cossey's address focused on the topic, "Diversity: A Context for Math Education." Following the keynote address, attendees participated in a refreshments buffet, and door prizes were awarded.

The Fair was described by collaborative Director Lise Dworkin as follows: "The Math Fair was a project developed by twenty elementary, middle and high school teachers that was presented at the Spring Math Conference. The Fair offered a multitude of problem-solving activities representing the different strands of mathematics described in the California State *Framework* for Mathematics: number, geometry, measurement, logical thinking, patterns and functions, probability and statistics, and algebra. Using characters from *Alice in Wonderland* as a theme, the activities were presented in independent stations or centers in which participants could engage in them at their own pace. Materials were provided that replicated the activities so that they were ready for classroom use."

Approximately 460 participants attended the conference, including 300 elementary teachers, 100 middle school teachers, 50 high school teachers, 4 representatives from higher education, 3 school district representatives, and a representative from Citicorp. The limited participation by high school teachers was attributed to the fact that many of them perceived the conference as being for teachers of grades K-8, which had been true of the previous year's conference. The registration fee for the Conference was $5.00 and included refreshments. Teachers were encouraged to register early to ensure that they could attend the workshops of their choice.

The attendees seemed to enjoy the Conference greatly, with the overall rating an average of 4.5 on a scale of 1-5, with 5 as the highest. Two-thirds of the individual sessions were given a rating of 4.5 or greater. The keynote speaker received an average rating of 3.8. In their evaluations, some of the teachers made the suggestion that the Conference should not be held on a school day and that it needed to be longer to allow more time to visit the exhibits at the Math Fair. One teacher commented, "Good location, student helpers were great! Workshop themes were varied--good selections to choose from, fun, very inspirational. Just the right length of time for the speaker." A second teacher said, "It's hard to be enthusiastic after a full day teaching. Why not do this as an inservice day? Also need more K-2 activities." A third teacher remarked, "The directions by the students were wonderful. The 'hand posters' were very helpful. This was a very well-organized conference! Is there any way to attend more sessions?" A fourth teacher noted, "Somehow I think the Math Fair should be open at some point to all; with just two workshops you're sort of taking your chances at really attending 'useful-to-you' presentations." A fifth teacher said, "Keep doing this please! I'm a first year teacher." Among the other comments were: "Have it on a weekend so it can be longer!" and "Twice a year? All day Saturday with three sessions?"

Both the on-site observer and collaborative director praised the Conference. The on-site observer reported, "I thought it was a smashing success. I had the job of photographer, so I ran around taking pictures in all the workshops and I saw teachers totally engaged, usually in some hands-on activity, clearly enjoying the presentations. People were knocked out by the Math Fair, where activities for all grade levels were demonstrated in dozens of beautifully decorated booths. A common complaint was that not everybody got a chance to visit the Fair. People's comments ran the gamut from negative to positive on every possible topic, from the temperature of the building to the quality of the food. In general, I think the comments made by attendees reflect the highly positive response the conference received." Lise Dworkin reflected, "The Spring Mathematics Conference was a significant event in mathematics education for San Francisco. There seemed to be a great feeling of camaraderie among the participants and an excitement about all grades being together at one conference. Many people commented on what a great success it was."

## Planning Meeting for Speakers at the Spring Mathematics Conference

The collaborative sponsored a dinner meeting for the 30 speakers who would be workshop leaders at the 1990 Spring Mathematics Conference on February 22, 1990, from 4 to 6 p.m. at the Benjamin Franklin Middle School Library. A team of four who had attended the "Leading Mathematics Into the 21st Century" conference planned the meeting. The team included Carol Langbort, Maria Santos, Cheryl Lee (a teacher), and Lise

Dworkin. Of the 30 presenters who were invited, 21 attended, including 12 elementary school teachers, 5 middle school teachers, 2 high school teachers, and 2 representatives from higher education. The collaborative director and a district curriculum leader also attended the meeting. The poor attendance by high school teachers was especially noted.

At the dinner meeting, the speakers were given a copy of the NCTM *Curriculum and Evaluation Standards*. They then broke into four cooperative groups organized so that speakers of similar topics were grouped together; the groups then read material from the *Standards* related to their topics. After the small group discussion, each group summarized its topic for the others. The speakers were expected to demonstrate principles based on the *Standards* in their presentation in some way. This activity was followed by dinner, after which the speakers had an opportunity to visit the rooms in which the workshops would be held.

The workshop leaders who attended the dinner meeting felt that the evening was worthwhile. The on-site observer reported that the "teachers seemed genuinely impressed with the document [*Standards*]."

An elementary teacher commented, "This [the *Standards*] is a great book! I'm so glad they gave everyone one of these. I didn't even know about it but it validates so many of the types of things we're trying to do. It's really exciting to feel part of a nationwide effort." A middle school teacher remarked, "Where are all the secondary people? I guess they think they know it all already. Maybe they already have a copy of the *Standards* but I have a feeling they don't have any interest in them."

A representative from higher education said, "This was a nice thing to do for these teachers. The format was well thought out, I thought. Teachers had time to really look at the document and talk to their colleagues about it. Having the groups was a good way to organize it and involve the participants. And it's nice to have dinner for everybody after a long day." The on-site observer added, "Well planned, well conducted, nice dinner. I thought it was a good way to introduce the *Standards* to people who are likely to be leaders in implementing them. It was also a good way to help get the *Standards* some attention at the upcoming spring conference."

## Cross-Grade Visitation Program

At the beginning of the 1989-90 school year, the collaborative initiated a Cross-Grade Visitation Program to enable teams of teachers to observe each other's classrooms as each teaches mathematics. The program was designed to promote understanding of mathematics teaching across grade levels. The cross-grade visits were also seen as an important tool for developing horizontal consistency and vertical continuity in the district's mathematics curriculum.

Each team participating in the program was composed of three mathematics teachers (one each from an elementary, a middle school, and a high school). Each team met first to plan the topic(s) to be observed (i.e., geometry), then they visited each others' classes in action, having received release time to visit the team members' schools. Afterwards, the teams met to discuss their observations and to facilitate coordination of different teaching levels. The first year of the program, 1989-90, got off to a good start with four teams participating during the 1989-90 school year. Those who were members of teams were enthusiastic about their experiences and were very interested in publicizing the activity to increase the number of teams for the next year. In the future the collaborative will encourage the formation of a greater number of teams and classroom visits within schools, among schools in close proximity, and among feeder schools.

## Grant Awards Program

During the 1989-90 school year, the San Francisco Education Fund offered two types of grant awards to teachers: Small Grants and School Team Grants. The collaborative publicized the FUND's Grant Program, encouraged teachers to apply, and offered ongoing assistance to teachers interested in writing proposals. In the six years prior to the inception of the collaborative, only two grants had been awarded to mathematics teachers. In the past four years, however, 64 proposals for mathematics projects were submitted and 36 were funded. In 1989-90, a total of 22 grants for mathematics projects were submitted and 16 were funded. For example, two of the projects, the Language of Mathematics and Math and Science In Our Neighborhood, were submitted by elementary school teachers. One project, Using Computers as the Key to Math Success, by a middle school teacher, and three projects, Using Calculators to Enrich Math-A Curriculum, An Intermediate

Approach to Improve Math/Science, and Math for the 21st Century, were submitted by high school teachers. Last year, by contrast, 22 grants were awarded to mathematics teachers.

In addition to supporting the Grant Program sponsored by the FUND, the collaborative awarded 16 Travel Grants, 9 to teachers who wished to attend the Asilomar Mathematics Conference and 7 to teachers to attend the Annual Meeting of NCTM in Salt Lake City. The SFUSD provided release time for these teachers to attend the conferences.

## Small Grants

During the 1989-90 school year, the San Francisco Education Fund offered small grant awards to teachers. To encourage teachers to apply for the grants, the Education Fund offered three proposal-writing workshops in September and October, 1990. Two rounds of small grant competitions were held in 1989-90.

Spring semester grants, based on proposals submitted by October 27, 1989, were awarded for up to $1,000 for projects conducted during the period from February 1 through June 15, 1990. One-year grants, for proposals submitted by March 5, 1989, were awarded for up to $2,500 for projects conducted from September, 1989, through June, 1990. Three categories of grants were awarded. Experimenter awards were one-time awards to fill a need discovered after the start of school and for which other funding was not available. Disseminater awards were directed toward helping a teacher disseminate an idea that had been developed. Adapter awards were granted to teachers for the creative adaptation of a project being disseminated through the FUND to meet an individual school's needs. A total of 19 mathematics proposals were received for semester-long and one-year grants to be implemented during 1989-90. Thirteen of these were funded.

An example of four elementary school grants awarded for the spring of 1990 include one for an intensive inservice on using mathematics manipulatives to all teachers at the school; one to obtain manipulatives and to inservice teachers on their use; one to purchase manipulatives; and one to purchase "Touch" math materials. Three of the one-year grants awarded include one to a team of four elementary teachers for the purchase of an overhead projector and manipulatives to help improve the ability of students in the language of mathematics; one to a high school teacher to purchase 90 calculators and resource materials to spark students' enthusiasm by expanding their mathematical computation for meaning; and one to a high school teacher to purchase books, software, and other materials to begin an advanced placement mathematics program for high school.

## School Team Grants

During the 1988-89 school year, the collaborative, through the San Francisco Education Fund, initiated a trial program for awarding School Team Grants of $5,000 to middle schools and high schools and grants of $3,500 to elementary schools. These grants, modeled after the Los Angeles +PLUS+ Team Grants, were to be awarded to school mathematics departments for projects designed to identify and address high priority needs throughout the department or the school. The projects that were funded had to be planned through the cooperative efforts of the principal, assistant principal, department head and teachers, by teams comprised of four to six teachers and directed by a department head, principal or assistant principal. In addition, the involvement of parents, students, community members, and other central office staff was expected.

In the spring of 1989, Team Grants for the 1989-90 school year were awarded to three schools, but only two decided to pursue their grant programs. Lincoln High School received and completed a project to develop a series of pilot lessons stressing the use of cooperative learning and modern technology to improve students' interest in algebra. Jefferson Elementary school received and completed a project to train teachers for implementing the California's *Mathematics Framework*. Raoul Wallenberg High School received a grant to institute a more integrated and relevant interdepartmental approach to the teaching and learning of both mathematics and science, but dropped out of the program because of too many other commitments.

Preliminary applications for team grants for high school mathematics were due on November 22, 1989, and teams selected to participate in the planning phase were notified by December 15, 1989. Each team designated a team facilitator, who attended an initial leadership meeting on January 18, 1990. All team members were required to participate in two planning sessions and workshops held on Saturday, February 24, and Saturday, March

24, to assist them in preparing their final proposal. The workshop, "Problem Solving Demands Good Problems," was led by Lyle Fisher, director of the Bay Area Mathematics Project, and provided an opportunity for participants to work together on developing problems and an understanding of what makes good problems. Team members received a stipend of $15 per hour for attending. Limited space was also available at the workshop for high school teachers who were not involved in the School Team Grant Program.

Final proposals were due to the San Francisco Education Fund on April 13, 1990. The Selection Committee, composed of educators and representatives from the community and from business, made its final recommendations to the Board of Directors of the FUND on May 14, 1990, with the award of the grants subject to final approval of the Board of Education on May 22, 1990.

Mathematics teams from three schools submitted proposals to be funded in 1990-91-- two from high schools (Balboa and Wilson) and one from an elementary school (E. R. Taylor). All three were accepted, but Balboa withdrew before the beginning of the school year. The goals for the Wilson High School project are to minimize the number of failures in freshmen mathematics classes; implement with science an interdisciplinary approach to the teaching and learning of mathematics; make changes in the freshmen mathematics courses to maximize student success; and provide planning time and staff development activities to implement this program. The funds for the grant will be used for teachers' inservice, materials (including manipulatives and videos), computer software, and teacher resource materials. The primary goal of the E. R. Taylor Elementary School project is to articulate mathematics instruction among the grades to better reflect the principles of the California *Mathematics Framework*. This will be done through having a mathematics fair, increasing the use of "hands-on learning," and dispelling negative attitudes about mathematics among 4th- and 5th-graders, teachers, and parents. Most of the $3,325 grant is for materials for the mathematics fair and classrooms. Some money will be used to pay teachers for working extended hours, to provide two days of release time, and to pay for a district consultant.

## The STAMP (Students and Teachers Acquiring Mathematical Power) Project

As a result of the networking activities fostered by the collaborative, three collaborative teachers, working with Professor Uri Treisman of the University of California at Berkeley, submitted a proposal that received funding from the National Science Foundation in spring of 1989 for an innovative mathematics project to address the mathematics needs of minority children.

The STAMP (Students and Teachers Acquiring Mathematical Power) project, which is designed to encourage students of underrepresented ethnic groups to pursue the college preparatory sequence in mathematics, focuses on students during the transition from middle school to senior high school. Underlying the program is the belief that all students are capable of understanding and doing mathematics. During the summer of 1989, incoming freshmen who had been identified as high-risk students participated in a STAMP pilot summer program to strengthen their mathematics. During the academic year, these students were clustered in special classes at three high schools, where they worked in small groups on situation-based problems to help them expand their knowledge of mathematics and to develop the mathematical skills and understanding needed to succeed in algebra. Two of the high schools received funding for the STAMP program through NSF and the district, while the third high school, Wilson, received funding from the collaborative.

During the summer of 1990, with funding from the district, NSF, and the collaborative, 50 8th- and 9th-grade students will participate in the STAMP summer program at San Francisco State University. In the fall of 1990, these students will be participating in the STAMP program being offered at three district high schools. A total of 90 students, including those from both the 1989 and 1990 summer programs, will participate in the program at Woodrow Wilson High School. Teachers at the three high schools affiliated with the STAMP program will receive additional resources, including release time and district and university support, to enable them to continue the restructuring of the Math A and Algebra courses. Citicorp representatives visited Wilson High School in May, 1990, to discuss the applications for mathematics with STAMP students and teachers. During the school year, the collaborative director attended a STAMP project inservice and visited classes at Wilson High School.

## Regional and National Conferences and Follow-Up Workshops

The San Francisco Mathematics Collaborative awarded travel grants to support teachers' attendance at regional and national conferences. Teachers who received travel grants were expected either to share their experiences and knowledge informally with the Collaborative Council or to participate in a follow-up workshop to share ideas from the conference with their colleagues.

### Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored the one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: 1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; 2) to help teachers develop a strategy for local change tied to an issue that is critical to the growth of their collaborative; 3) to provide teachers with a forum to think about their vision for the teaching profession and educational system as a whole; and 4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions of being effective as leaders in schools: understanding and communicating with people in an organizational setting and exercising organizational leadership.

Four collaborative teachers, including on-site observer Dan Bennett, attended the Teacher Leadership Workshop. EDC had agreed to sponsor two teachers from each collaborative, paying for room, board, registration, and transportation. The San Francisco Mathematics Collaborative paid for the third and fourth teachers to attend. The four teachers were selected by the Collaborative Council in an effort to secure representation from different grade levels and to include those who were interested.

Overall the workshop appeared to be successful, with most participants finding it valuable on a personal level and enjoying the opportunity to establish connections with teachers from the other collaboratives. The teachers from San Francisco appeared to be a little frustrated that they were not able to develop their action plans more fully. One teacher commented, "The presenters were really first rate. They really knew what they were talking about. I enjoyed Maurice Sykes and his networking activity. Grady's presentations were very well thought out and useful. I didn't feel we gave enough attention to the issue of greatest importance in our district, equity." A second teacher remarked, "I enjoyed a lot the networking and the Myers-Briggs personality typing. The rest of the week wasn't flexible enough--all our time was too planned out and I felt we missed the opportunity to put all that talent from around the country to work coming up with creative solutions to real issues. We didn't have enough time to just talk to each other and find out what other people are doing." A third teacher said, "I got a tremendous amount out of it, personally. I learned a lot about myself, and especially about weaknesses I had in interpersonal communication that I wasn't aware I had. I also really enjoyed meeting teachers from all over the country. What a great group!"

## The 32nd Annual Asilomar Mathematics Conference

The Collaborative Council awarded travel grants of $150 each to ten teachers to attend the 32nd Annual Conference of the Northern Section of the California Mathematics Council at the Asilomar Conference Center at Pacific Grove, California, December 1-3, 1989.

All K-12 teachers of mathematics were encouraged to apply for the travel grants. In order to be eligible, a teacher had to be attending the Asilomar Conference for the first time, must not have previously received a travel grant, and had to be willing to share ideas informally from the conference with the Mathematics Collaborative Council. Participants were also encouraged to share ideas at school faculty meetings. The Mathematics Collaborative Council had announced that four grants would be awarded to teachers of grades K-5, three to teachers of grades 6-8, and three to teachers of grades 9-12. Sixty-one applications were received for the ten available travel grants.

The Opening Session of the conference, which was held at Pacific Grove Middle School, featured Dr. Heinz-Otto Pietgen of the University of California-Santa Cruz who gave the keynote address, "Fractals for the Classroom." Several Early Bird Sessions were held on the Asilomar grounds from 5 to 6 p.m. on Friday, prior to the opening session which began at 7 p.m. on Friday. On Saturday, participants were able to choose from nearly 225 workshops and sessions. In addition, teachers had the opportunity to visit an extensive display area featuring material from all 50 publishers participating and to attend a Make-It Take-It drop-in session. During the Conference, a television crew from Sixty Minutes filmed John Saxon for an upcoming television program on the use of his book in Ukiah, California schools, and the controversy that is being generated by the conflict between Saxon's philosophy, which is a highly structured approach to learning mathematics, and the ideas in the California Mathematics *Framework*, which embraces the NCTM *Standards*. Teachers held lively debates on the topic between conference sessions.

The teachers who received the travel grants were invited to the December 1989 meeting of the Collaborative Council to share their reactions to the Conference with Council members. One teacher commented, "I had a really wonderful time. I heard a lot of really interesting sessions and got a lot of things I can use in my classroom. I went to a Make-It Take-It and got the stencils for making solids and those other shapes you can fold and stretch--they're just amazing. And I'm interested in organizing math contests in my school and I got a lot of good materials for that. I also enjoyed meeting people at that party (cosponsored by the San Francisco Math T.E.A.M. and SFMTA). I'd definitely go again on my own." A second teacher said, "I wouldn't have gone if it hadn't been for the grant. I've heard so much about it but it would always come and go and I'd forget about it. Seeing about the grant and getting the money motivated me to finally go. I'm sure I won't miss it again, it was a neat experience. It was so exciting to hear people's different ideas." A third teacher added, "I didn't get anything I can really use with my students. I wouldn't have gone without the grant, but I don't think I'd go again. Those people don't really have the answers and I've been teaching a long time--I don't plan to change how I do it now." Overall, the director noted that Council members enjoyed the meeting. Having the attendees present the summaries in small groups provided an opportunity for teachers from different grade levels to interact with each other.

The on-site observer reported, "This conference can be very inspiring and rejuvenating and I got the impression from most grant recipients that they were thrilled to have heard new ideas and that the conference made them feel they were no longer isolated. The impact on these teachers, I believe, is that they will become active in other activities and will probably spread this spirit to their colleagues."

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Eight collaborative members, including six teachers, the collaborative on-site observer and the collaborative director, attended the 68th Annual Meeting of NCTM in Salt Lake City, Utah, April 18-21, 1990. Six of the teachers received travel grants of $500 each to help cover their expenses. The Collaborative Council had originally planned to award travel grants to four elementary school teachers, four middle school teachers, and two high school teachers, but only two K-5 teachers and one 6-8 teacher applied. While originally only two grants were to be awarded to high school teachers, three high school teachers were given grants. In order to be eligible to receive a travel grant to NCTM, teachers must not have previously received a travel grant, must be willing to attend full days of conference sessions, and must be willing to present a workshop in May on ideas gained at the conference. Applicants had to complete a form indicating the mathematics courses they teach, the inservices they have attended, and why they wanted to attend the conference. In addition, each applicant also submitted a letter of recommendation from his or her department head or school principal.

The theme of the NCTM conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all parts of the United States and Canada, as well as from countries around the world, convened in search of new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

The on-site observer reported, "All of the grant recipients I spoke to were enthusiastic about the experience and considered attending a national conference a milestone in their professional growth. Four of the five teachers I spoke to had never been to a national conference and would not have attended without the grant. All said they would like to attend future conferences. The opportunity to meet other teachers from around the country and be exposed to innovative ideas and movements in math education will, I believe, have a significant positive impact on the professionalism of the teachers involved and on their colleagues with whom they share their experiences."

A workshop, "Highlights of the Annual Conference of the NCTM," was scheduled for May 10, 1990, to enable the teachers who had received travel grants to the NCTM conference to present some of the highlights. Among the topics that were to be discussed were new methods that stress mathematical reasoning and mathematical connections and issues in mathematics teaching in the multicultural classroom. Due to a poor response from teachers, however, the workshop was canceled.

## E. Observations

### Project Management

The 1989-90 year was the first full year during which the San Francisco Mathematics Collaborative operated under its reformed governance structure. This transitional period was a time of adjustments when people were becoming more comfortable with each other. The collaborative made strides in achieving this spirit among groups that had for historical reasons not always been collegial--where there had been tension between the teachers and the district, and between the secondary teachers and the elementary teachers. What the collaborative served to provide, primarily through the Council, was an organization that brought representatives from these different groups together to address issues of mathematics education in the district.

Evidence that the collaborative is becoming institutionalized was apparent during the year. The commitment of the San Francisco Education Fund to the collaborative was apparent in the fact that staff and FUND board members regularly attended collaborative meetings. This, as well as the collaborative director's presentation to the FUND's Board of Directors, provides indications that the FUND is interested in what the collaborative is doing and how it is proceeding. The commitment of school district support to the collaborative is evident in its funding of the director's position for the school year and the value it places on the activities of the collaborative. Following the Spring Mathematics Conference, the director of curriculum for the school district wrote the collaborative director a note indicating the district's delight in the success of the Conference. The deputy superintendent for the school district reported that the collaborative has contributed to the district's efforts by generating more interest among people in working together--teachers working with other teachers, teachers working with staff from the Exploratorium, and district representatives working more closely with those from the FUND.

Evidence of institutionalization was also apparent in the smooth transition made by the Council membership at the end of the school year. The process of electing new teachers to serve on the Council has worked well for two elections. In the May 1990 election, a slate of 14 teachers was generated and over 300 teachers (two-thirds elementary) voted. Having this mechanism in place for replacing Council members helps to further the stability of the collaborative and assure its duration.

Another factor leading to more stable institutionalization is the number of teachers who are being reached by the collaborative and the number of teachers who are willing to participate in developing its programs. A large number of teachers worked to prepare for the Spring Conference. The collaborative is still growing, which means it will revitalize itself by continually bringing in new teachers and not being dependent on the same teachers year after year.

An issue during the year was the balance of power within the collaborative, the definition of roles, and decision making. The Collaborative Council was designed to be teacher-driven. The role of the director was conceptualized as being responsible for carrying out the plans of the Council. More time was needed for administration of the collaborative than could be managed by Council members. Day-to-day decisions had to be made, options had to be investigated, and recommendations had to be brought to the Council meetings for action. At the beginning of the school year, an effort was made to identify a teacher willing to run the Council meetings, but none of the teachers agreed to do this. In place of a teacher, the director continued to chair the meetings and assumed the leadership of the Council, as well as responsibility for fulfilling the recommendations of the Council. This situation continued until May when a new policy was implemented that entailed rotating the Council chair every two months among the teachers. A reason for this change was that some of the teachers on the Council felt that teachers should have a greater leadership role on the Council. The question arises as to why it took nearly a year for teachers to institute such a change. Teachers were hesitant to assume leadership. This seemed to be due to the fact that some of the teachers were new to the collaborative and did not feel as if they knew enough about it to take a leadership role. The more experienced collaborative teachers seemed to be involved in many other activities, making it difficult for them to assume additional responsibilities. Although teachers strongly supported a teacher-driven Council, they were not ready for a variety of reasons to assume responsibility for directing the collaborative. This also may be an indication of the reluctance of some teachers to take risks. This tension over the control of the collaborative seemed to work out as people got to know one another and found ways to work together. Both are important for shared decision making. The format of both the Council meetings and subcommittee meetings has varied over the year, partly because members of the Council are still attempting to determine how they can best work together. The question remains of how lasting the changes made at the end of the school year will be and when the format of the Council will stabilize so that it can become more effective.

Another indication of the Council's progress toward stability is that some effort has been made to acculturate new members. With the first election of members in April, 1989, essentially all Council members were new to the process, yet they were given no introduction to the collaborative's role and function. This was not necessary for the secondary teachers who had previous experience with it, but some elementary teachers did not fully understand the operation of the collaborative for several months. One elementary teacher reported not feeling very productive during her first year on the Council, "For me, the first year was just figuring out what was going on."

The following year, efforts were made to inform teachers who had been newly elected in May, 1990, about the mission of the collaborative. Part of this process included giving individuals some idea of why they were on the Council and what role they were expected to serve. A business representative of the FUND sat in on some of the Council meetings--a person who also had a question as to what role he should play. He had specific ideas regarding governance and how the meetings could be conducted more efficiently, but because he had only been to one or two meetings he did not feel it was appropriate for him to offer his opinions. He wanted to get to know people first and to work with them, feeling that only after this kind of interaction are people receptive to new ideas. An opportunity was apparently missed when a subcommittee of the Collaborative Council discussed the restructuring of its operations without representation from the business sector.

For the most part, the collaborative has been successful in structuring the Council to include people from a broad range of groups. During 1989-90, however, the expertise of Council members was not used to optimum effect in pursuit of the collaborative's goals. It is evident from the experience of governing boards in other collaboratives that if participants do not feel their time is well spent and of value to them personally as a member of the group, they will soon drop out. To find something of value for people to do generally takes initiative on the part of the chair or the director of the group. This can be a potential problem for the San Francisco Mathematics Council when a rotating chair is formally adopted because the chairs will tend to focus more on conducting the meetings than on the strategic planning needed to make the best use of the talents of group members.

Having a full-time director has served the collaborative well in implementing programs. The director has been responsible for obtaining speakers, arranging meeting space, and handling administrative details. The director has also helped in furthering communication with the different interest groups. Teachers have expressed some concerns regarding the role that the director should have with respect to the district. Teachers objected to Lise Dworkin serving on a team to assess the quality of a mathematics and science program at one of the schools in the district. They felt that this put her in the position of making a judgment about teachers, whereas she should be thought of more as an advocate of teachers. Some district responsibilities were associated with district funding of the position for the year and it is normal operating procedure for staff at Parkside to serve on teacher evaluation teams. But the relationship between the collaborative and the district is not well-defined and requires that the director continually reassess the nature of that relationship. The director, whose position is defined as a mathematics resource teacher in the district, has to answer to both a district supervisor and to the FUND's Board of Directors. This dual responsibility seems to have created mixed messages.

The director's main link with the district is through the mathematics team leader. This relationship has worked well and provides the opportunity for the district to support collaborative functions by offering stipends and other funds when appropriate. What the relationship should be between the collaborative and the district is not fixed in people's minds. Some teachers feel that the collaborative director should have an office independent of the district's mathematics office and that meetings should be held in places other than at Parkside. The director was sympathetic to this view but did not believe change was appropriate in June, 1990.

As a result of overseeing the management of the collaborative, the role of the San Francisco Education Fund has itself become more complex. In the early stages of the collaborative, the FUND's director referred to her agency as a clearinghouse for education, where information is centralized and then disseminated as needed. Four years later, and after many hours spent on working with collaboratives and other endeavors, Director Gladys Thacher described the FUND's role as that of an intermediary--an organization that hooks in with the national movement, brings in corporate funds and expertise, and actively works with teachers. Ms. Thacher attributes this change to the Ford Foundation and its insistence on addressing important issues of structure, the relationship with the school district, and funding in the permanence proposal. The process has changed the FUND's relationship with the school district. The director reflected, ". . . [W]e never knew how intimately we had to work with the school district." This transformation in thinking is not equally shared by everyone on the FUND's Board of Directors. Some still see the FUND's primary role as that of issuing small grants to teachers. Slowly, members of this group are becoming aware of the intermediary role the FUND can have in the area. This changes the focus of the FUND to an emphasis on operating programs that need stability and funding. Prior to the expanded role of the FUND, its director noted, "Raising funding for the collaborative has been kind of a stepchild of Ed FUND priorities." There is greater conviction that the FUND will continue to evolve in stages rather than to serve one function, as previously envisioned. A part of this growth will result from becoming more proactive, from learning how to portray the FUND, and from helping the business community and schools know what the FUND can do. It would behoove the FUND's Board of Directors to realize that there has to be an ongoing effort to reflect on the FUND's role. "[The journey with the collaborative] puts us on notice that these were things we had to pay attention to all of the time," commented the director about the evolution of the FUND's role in the development of the collaborative.

**Collaboration**

Many facets of collaboration have been woven into the fabric of mathematics education in San Francisco. Teachers are collaborating with other teachers. People from higher education have found the mathematics teachers to be an important link between their programs and the schools. The school district is gaining a greater respect for the power of collaboration. The Exploratorium and mathematics teachers have found a mutual beneficial relation in the capacity of the Exploratorium to open the eyes of teachers to mathematics in the physical world and in the capacity of teachers to open the eyes of the Exploratorium staff to mathematically based exhibits. Teachers have heard people from the business world talk about their employee needs and their business applications of mathematics. The FUND is interacting with the school district in new ways that require a closer involvement by each sector. Groups of mathematics teachers, separated from each other over the years and by different grade levels, have sat down together and worked with each other. Through these different forms of collaboration, the teachers are getting to know other mathematics teachers in new ways; they have expanded their networks, and they beginning to see teachers from other grade levels as their colleagues. As a result, teachers have gained confidence in their classroom practices and have raised their expectations for the students in their classrooms. Teachers report that they are more involved in mathematics and feel they have an inducement to become better teachers. The interaction of teachers of mathematics across the grade levels, K-12, is better than it has been for some time. As the collaborative director noted, the district now has a core of activists.

The K-12 expansion of the collaborative has increased the number of teachers who have had some involvement in its activities. Out of the potential of 1,500 teachers who teach mathematics in the district, over 400 attended the spring conference co-sponsored by the collaborative. Over 300 teachers voted in the 1990 elections for the seven seats on the Collaborative Council. An estimated 170 of the 250 secondary teachers have attended some collaborative activity. The very active teachers, according to the director, number about 50 high school teachers, 30 middle school teachers, and 50 elementary teachers.

There is no question that the collaborative has enhanced the professional lives of teachers of mathematics and has afforded them many opportunities to attend meetings, hold conferences, and participate in workshops. But some issues that have arisen highlight the difficulties of collaboration and of developing a collaborative as an organization. These issues have been particularly apparent in the attempt to create meaningful interaction and involvement of teachers across the thirteen grades. One problem is that the self-interest of people does not always coincide with the principles of collaboration and, in fact, can create barriers that have to be dealt with. Another is the need to have a common focus, something that all can value and relate to. A third issue is equality; each person must sense that his/her participation is as valued as another's. A fourth issue is trust. Partnerships in collaboration are not always formed by choice, but by need. Sometimes adversaries and strangers have to join to achieve effective collaboration. It requires time and interaction to develop the trust that is needed to build effective working relationships. A fifth issue is simply that of possessing a common language to communicate in a meaningful way with others. High school mathematics teachers have developed a language they use to talk about the curriculum and their students' mathematical experiences. This does not always correspond to the language used by elementary teachers who see mathematics as only one of many subjects that their students need to learn. Each of these groups uses a language different from that used by those in business, who are profit-motivated and efficiency-driven.

Many of these issues have surfaced as the San Francisco collaborative has tried to bring together teachers from across the grade levels. Teachers have expressed appreciation for the cross-grade level interactions that they have had and the opportunity to build through the collaborative. But there still is some distrust and a perceived lack of interest on the part of some teachers regarding what teachers from other grade levels are doing. A common focus has not been established.

One 5th-grade teacher was leery about having a K-12 collaborative. She was not interested in some of the issues that the high school mathematics teachers found important, such as the district mandate that same algebra textbook be used by all algebra teachers. She felt that high school teachers excel in mathematics, but that she also had valid ideas to offer about teaching such as working with groups. Her perception was that the high school teachers are primarily interested in mathematics, ". . . as soon as you take away the 'mathness' of it, I think you take away a lot of the high school teachers." This strength of feeling is not shared by all elementary teachers. A 1st-grade teacher had become very interested in mathematics through the California Mathematics Project and now teaches mathematics without a textbook, using a wide range of manipulatives. In serving on the

Collaborative Council and through other activities, she felt that she has gotten to know high school mathematics teachers. This has changed her opinion of middle school and high school mathematics teachers. In relaying her feelings about upper-level teachers, she commented, "I used to think everything happened in primary school and high school did just the same old thing. Now I know there are people who are really committed to what they are doing." This teacher has gained trust of high school teachers by realizing that at both levels, teachers have a common commitment to serving their students.

A middle school teacher, who has been active in the collaborative, voiced a similar perception of high school teachers as being mainly interested in mathematics. He felt that middle school and elementary teachers were more interested in teaching mathematics to everybody. His perception is that in high school a greater proportion of mathematics teachers see themselves as mathematicians, that "if you do not understand math, I'm not really interested in you or what you do." But for this teacher, the collaborative has helped to bridge the gap between the groups and has enabled each to be more open to what the other is doing. He went on to comment, "The most difficult job is not only getting teachers together but now getting them together across grade levels--making them aware and interested in what's going on in programs in grade levels other than their own."

The perception of high school mathematics teachers by elementary and middle school teachers has some validity; however, high school teachers also have expressed appreciation for the collaborative's change to a K-12 focus. The on-site observer admitted that he would not have attended the events planned for middle school teachers except for having to document what was happening. After attending the events, he found them to be very interesting and informative. Another high school mathematics teacher felt that fruitful things had come out of the transition of the collaborative to K-12. A third high school teacher sensed a better feeling among teachers from the different grade levels since the collaborative had expanded its group to include elementary and middle school teachers. The high school teachers value having teachers from the other grade levels involved, but do not go so far as to say that they have something to learn from them. At least some are not ready to grant elementary and middle school teachers equal status as a source of information on teaching mathematics.

The district administration is supportive and pleased with the collaborative's efforts to include all district teachers of mathematics. The administration is proud of the progress that has been made in having teachers from across the grade levels work together. The deputy superintendent proudly observed, "We broke the ice of elementary teachers not thinking they are equal with high school teachers . . . K-12 works."

The conditions in San Francisco are such that a K-12 collaborative has perhaps a greater possibility of working there than in other city districts. An important reason for this is the existence of active special interest mathematics groups that include both one for the secondary teachers and one for the elementary teachers. The San Francisco Mathematics Leadership Project, under the direction of Dr. Carol Langbort, has enlivened interest in mathematics on the part of a strong core of elementary teachers. This group meets monthly and constitutes the nucleus of T.E.A.M. The SFMTA and the collaborative together have achieved a similar result for secondary teachers. This, along with those from higher education who work with teachers from all grade levels, account for the number of teachers active in mathematics at all grade levels. The collaborative is the first group in the area that has tried to bring these groups together and it has had some success. But the comments of teachers indicate that the true collaboration of K-12 teachers--all contributing and all feeling equal--has not yet been fully realized. The collaborative director sees the joining of teachers from the different grade levels as the collaborative's biggest challenge, but feels that it is going to take at least three years for the teachers to become familiar with the issues, to want to get involved, and to assume ownership.

Other forms of collaboration have been expanded through the mathematics collaborative. As noted in the Project Management section above, the FUND is now serving as an intermediary for the district. This relationship can be at least partially attributed to the fact that the Ford Foundation required that the FUND and the district rethink the role and function of the collaborative and that they each be specific about their relationship with the other. Members from the higher education community have been active colleagues in the collaborative from its beginnings. This relationship has been self-reinforcing for both groups. The colleges and universities in the area have developed a teacher clientele for courses they offer and have made connections for the placement of student teachers. The teachers have gained through having faculty from academic institutions give workshops on topics related to the latest trends in mathematics education. The collaboration with business has waxed and waned over the span of the collaborative. The Chevron dinner lecture series, given during the first three years of the collaborative, was very valuable in bringing together teachers and people from business. Teachers report that they gained a greater sense of the expectations of the business sector for their students. However, since these dinners were discontinued, contact with the business world has diminished. The two corporate representatives who serve on the Council were still, at the end of the year, trying to decide what their place was with respect to the group. Over the year the interaction between these two business members of the Council and the teachers was minimal.

The collaborative goals list six basic functions for the collaborative: dialogue among K-12 teachers and others; a "safehouse" for free expression by teachers; collegiality; improved mathematics teaching and learning; a vehicle for investing in mathematics education; and discussion of issues. The perceptions of active participants about what the collaborative has in fact achieved are diffuse when contrasted with these goals. Different people note different aspects. At the last Council meeting in June, 1990, a teacher who had been with the collaborative from its beginning spoke briefly to the changing direction of the collaborative. To her, the collaborative had undergone a transition from promoting professionalism among mathematics teachers to serving more as a provider of staff development. The director responded that the collaborative had adopted new goals related to disseminating the NCTM *Standards* and focusing regularly on equity in its activities.

The collaborative is viewed in different ways by people from the different groups that comprise it. This indicates the eclectic nature of the San Francisco Collaborative. The teachers give the collaborative credit for increasing their knowledge of national trends, contributing to their professionalism, being advocates for their professional growth, and maintaining a collegial group. A person from business, when pressed, felt that it was important to look at improved student test scores, but also noted the importance of teachers having the opportunity to talk with each other. A district administrator saw the collaborative as a resource through which teachers acquire new knowledge that will enhance their effectiveness; he recognized that the collaborative, with only minor support, expanded the energy and impact on students and teachers. A principal viewed the collaborative as a change agent, something to motivate the desire for change and for doing things differently. A person from the FUND viewed the effect of the collaborative as building an aware, articulate, group of teachers, who are comfortable with themselves and bonded to those with whom they work in the fields of mathematics.

Good has come from the collaborative. A sense of caution is in order, however, if the collaborative focuses on staff development as an end rather than as a means for empowering teachers by having them become action oriented. The collaborative has spurred teachers to think differently about change and about their own role in change. In an application to become a mentor teacher, a high school teacher wrote about her view towards instruction and what she has gained by attending activities through the collaborative, "I am committed to improving instruction and I have learned that the best way to do this is by working collaboratively with other teachers. . . .[Through activities encouraged by the collaborative] not only did I discover a whole new world of mathematics education, but I also discovered that I had something to contribute in return."

## Professionalism

The professional lives of San Francisco mathematics teachers have been touched by the collaborative because it has provided a group for them to be associated with--sponsoring activities and supporting trips to conferences that have extended their knowledge of mathematics and the teaching of mathematics, and giving them credibility. Over the five-year span of the collaborative, mathematics teachers have become more active due, at least partially, to the collaborative. In addition to attending conferences and workshops, mathematics teachers in San Francisco have manifested an increase in activism in three specific ways.

First, a teacher, in cooperation with a university professor, successfully submitted a proposal to the National Science Foundation for a major grant. The outcome is STAMP (Students and Teachers Acquiring Mathematics Power), a three-year project working with three district high schools and the mathematics teachers in each to better help students make the transition from middle school to high school. A principal at a school involved in STAMP noticed that the collaborative had been very important to mathematics teachers at her school, "Our teachers wanted to kind of change the way they were doing things. The math collaborative has brought them [new ideas] . . . by workshops, by the Asilomar conference, by dinner series, and then specifically by the STAMP project. . . .it's a way for teachers who have the desire to change to do things a little differently and draw more students in than teach in the 'old fashioned way'."

Second, over 42 teachers have attended the Exploratorium summer institutes. An outcome of this relationship is the development of resource materials for mathematics teachers to focus on Exploratorium exhibits in classroom activities. The booklet, prepared by the mathematics teachers, and completed during the summer of 1990, includes four types of materials--discussions of mathematical ideas, demonstrations such as that of a parabola as a perfect focuser of light, worksheets guiding activities that the teacher can do with students, and "math snacks" (activities that teachers can construct themselves to use with students in their classrooms). The math snacks are activities based on Exploratorium exhibits that can be executed with simple materials purchased at a hardware store. A staff member of the Exploratorium noted that the teachers came to the task with confidence in their subject, an understanding of teaching, and the realization that one teacher knowing the ideas and subject is not enough. The teachers participated in the institutes because of a desire to know more, not because they were trying to increase their credits for a credential. ". . . The thing that impressed me the most about [high school teachers] is the incredible dedication they have to what they do," observed this Exploratorium staff person. Through the collaborative, a group of teachers has expanded its knowledge of the applications of mathematics and has prepared materials that other teachers can use.

Third, mathematics teachers are much more aggressive in pursuing San Francisco Education Fund grants for the purchase of materials or other classroom support activities than they were prior to the existence of the collaborative. In the six years before the mathematics collaborative was established, the FUND had awarded only two grants to mathematics projects. In the first four years of the existence of the collaborative, 64 proposals for mathematics projects were submitted to the FUND and 36 funded. In addition to the FUND's grants, the district's mathematics curriculum leader has written a number of grant proposals for the outside funding of projects, such as a proposal she wrote with Carol Langbort to the San Francisco Math Triangle Teacher Expansion Development Project for teachers in grades 4 and 5 to develop geometry units. This proposal was submitted in the fall of 1989. The district's deputy superintendent identified grant writing activity by mathematics teachers as an outcome of the collaborative. In her view, after teachers have attended professional activities through the collaborative, they are "coming back . . . making their own plans . . . designing their own projects . . . applying for funding and designing their own ways of working in partnership with teachers and students."

Teachers of mathematics in San Francisco, when asked, agree that the collaborative has brought teachers and others together. It is a collective that gives teachers a visible group identity. For some teachers, it is the only local professional group in which they are active. The collaborative activities are having an impact on teachers. A 1st-grade teacher reported, "[The collaborative] has expanded my view of math education. . . .I see how first grade lays the framework. I see math as much more open-ended." As some teachers have reported, having a reference group and increasing their knowledge of mathematics gives them credibility.

As part of a series of interviews that were conducted by the UMC Documentation Project, the on-site observer asked five teachers questions about teachers as professionals. What emerged from those interviews was that mathematics teachers see themselves as teachers rather than as mathematicians. To them, their responsibility is "to get the information across, but not really to do it," as one teacher responded. The teachers valued professional organizations and found them useful as a resource for information and networking. The textbook was regarded as a strong influence on what they teach, but they also felt some freedom within their classroom to teach whatever they wish. According to a K-5 resource teacher, inservices are influencing elementary teachers to do more with hands-on, problem-solving, and portfolio type lessons. A high school teacher felt that teachers should have autonomy in determining what they teach, but that they had some responsibility "to make informed choices, based on research and other teachers' experiences." Teachers in San Francisco are not placed in the position of evaluating other teachers, nor do they want to be, although teachers would like to observe other teachers and to be observed by other teachers in order to get supportive feedback. The five teachers did not all agree on their contributions to society as teachers of mathematics. Some saw their contribution as teaching their students how to think, reason, and make sense of the world. Others felt their contribution was to teach people mathematics. One high school teacher felt that mathematics teachers contribute to a more math-literate society, but there also was a downside, ". . . I have a feeling we contribute disproportionately to the dropout rate. Our students' failure in math can be a first step toward failure in school." The picture of professionalism portrayed in these responses is one that is identified with autonomy and active participation in professional organizations; it does not contain a strong message about contributions to society, and indicates no interest in self-regulation other than through supportive sharing of initiatives and ideas.

Teacher leadership was one of the major themes throughout the UMC project during the 1989-90 school year. The San Francisco Mathematics Collaborative has helped to develop teacher leadership in some ways, but not all teachers felt that what has happened through the collaborative has empowered teachers to be leaders. The EDC Leadership Workshop in August, 1989, affected the five San Francisco teachers in different ways. One teacher valued what he had learned through the experience and reported that it had been directly useful for him in negotiating with district administration during meetings. Another delegate had not found the experience as productive because it focused more on developing leadership skills than on helping those who are already in leadership positions to improve demonstrated skills.

Other teachers were asked during the year about teacher leadership and the collaborative's role in fostering it. The responses were mixed and indicated that the collaborative had helped some teachers at some time, but that, during 1989-90, the atmosphere for developing teacher leadership was more constrained. Early in the collaborative's development, according to one teacher, the positive interaction of teachers with those from business and higher education served to increase the self-esteem of teachers, which resulted in teachers assuming a leadership perspective. The restructured collaborative with a full-time director and more formally organized council, according to three teachers interviewed at one point, has made the organization appear to be more director-driven than teacher-driven.

These comments were recorded well before the June 1990 Council meeting, when some adjustments in the operations of the Council were made; they might not have been as strongly felt toward the end of the 1989-90 school year. What the comments do indicate is that the restructuring of the collaborative has in a way made teachers feel a greater distance from decision making because now there is someone there who will go ahead and take initiative to keep things moving. Teachers were given the opportunity to run the Council meetings but did not come forward to do this. Even though teachers outnumbered other groups on the Council, they did not exert their numerical advantage in an effort to assume control of the group. Those who were most vocal in expressing concern about how much control teachers had in the Council were secondary teachers who had been with the collaborative from its beginning.

The expansion of the collaborative to K-12 and to a 1,500-member target audience has changed the composition of the collaborative so that it can no longer be run by an informal teacher advisory group consisting simply of those who show up at a particular meeting. Producing a conference such as the Spring Mathematics Conference requires extensive planning by a number of people over an extended period of time. The on-site observer noted the contradiction regarding the collaborative's expansion: there are negative feelings on the part of some of the teachers on the Council and yet the collaborative has during the year mounted a very aggressive program. In February, he commented, "It's ironic, because I think this year's program has been the best ever, but the teachers aren't giving themselves credit for that, or they're not making a connection between their attendance at meetings and the program."

The collaborative stills seems to be in transition in developing a form of governance that works with a full-time director and a teacher-dominated Council. This problem may resolve itself by having new teachers elected to serve on the Council, which would serve to bring in new ideas and people who are not identified with the old patterns. In this way, teachers without a history of working with the collaborative will be able to offer new ideas and nudge the collaborative in new directions.

## Mathematics Focus

The San Francisco Mathematics Collaborative sponsored many programs during 1989-90 that co-existed with a number of other mathematics education activities held in the Bay Area. Many of the collaborative's events drew from the rich resources available in the area. A major theme of the collaborative's activities during the year was mathematics reform. This general theme drew attention to the NCTM *Curriculum and Evaluation Standards* and the California *Framework*. The variety of types of programs available through the collaborative included those directed toward teachers at all grade levels, on the one hand, and, on the other, at those targeted specifically toward a more restricted group such as K-5 teachers or high school teachers.

The highlight of the collaborative program was the Spring Mathematics Conference, March 7, 1990, which offered a range of sessions and a mathematics fair, including exhibits based on an Alice in Wonderland motif. In preparation for the Conference, session leaders each were given a copy of the Executive Summary of the *Standards* and asked to incorporate ideas from that document into their presentation. For some, this was the first time they had heard about the *Standards*. It was a good approach, since it encouraged teachers to read the document and motivated them to use information from it rather than simply study its contents.

The Mathematics Education Reform series of three programs addressed issues related to the current reform movement. It was a dynamic series designed to present teachers with an opportunity (1) to learn what people were doing and thinking about in an effort to de-track students through employing such programs as the Interactive Mathematics Project, (2) to encounter new forms of assessment, and (3) to gain an idea of the political deterrents to the reform movement. These well-attended programs exposed teachers to people actively participating in mathematics education reform and enabled them to view what is being recommended in the *Standards* and in the *Framework* from a broader perspective. In addition to the reform series, a number of other workshops or presentations were held that focused on a particular area of the curriculum, or a perceived goal for the curriculum. including graphing calculators, probability, number sense, and Math A.

The collaborative has expanded teachers' perceptions of mathematics, their attitude toward mathematics as a field, and their understanding of their own teaching practice. As a result of the Exploratorium Institute experience, a teacher reported that she saw the world differently and has become curious. Dr. Thomas Humphrey, faculty member of the Exploratorium Teacher Institute, emphasized this point: "That just delights me because that really is the point. The idea is . . . that people really begin to see that their own curiosity and their noticing is a very large part of their individual lives." Out of this new capacity for curiosity, one mathematics teacher developed an exhibit idea for the Exploratorium--a pendulum turntable (demonstrating that the motion of the pendulum is the same as circular motion). Another high school teacher credits the collaborative with helping him to see that mathematics should not be taught in isolation, but should be taught in conjunction with other student experiences. For him, his teaching is more student-driven than curriculum-driven. This has raised his expectations for students, "I'm a little more open to trying different things . . . to pushing the kids a little harder. . . ." The notion that mathematical topics should be taught in relation to each other rather than as individual topics has also been communicated to elementary teachers. A 5th-grade teacher indicated that through becoming more aware of Math A by talking to collaborative teachers at different grade levels, some of her views were confirmed or reinforced, ". . . it seems to me that the way to teach math is not to segregate algebra and geometry, but rather to integrate them."

The change in the approach of the mathematics teachers to their teaching because of the collaborative is distinct enough that it is apparent to others. One high school principal, a former mathematics teacher, was very proud of what the mathematics teachers were doing in their classrooms and attributed it, at least in part, to the collaborative. The principal was asked if she had any indication of how the collaborative was becoming institutionalized within the district. She cited the two grants that the mathematics teachers had received and noted what mathematics teachers were doing. In expanding on the change, she said ". . . we are really going into [mathematics] with gusto . . . I've seen it. You can walk right now to the wing that has the math department classes and . . . see groups of kids working together. You will see kids actively involved. You will see the math class operating mainly like a science class [students experimenting]." The district's deputy superintendent also had noted changes and listed as one of the outcomes of the collaborative improved instruction in the classroom so that student learning is improving.

The expansion of the collaborative to K-12 has given individual teachers the opportunity to learn more about what is being taught at other grade levels. A 1st-grade teacher supported the need to have programs that reach across the grade levels. The issue of programming for an audience ranging across the K-12 spectrum may not be as formidable a problem as it might at first appear to be. What seems to be a bigger issue is encouraging teachers to become more receptive to what is going on in mathematics. An elementary teacher who had heard a speaker at Asilomar give a talk on fractals was very excited about the experience, ". . . I really felt like I was in a room with a genius . . . I didn't really understand any of it, but it was spectacular." This provided her the opportunity to hear a presentation she would not have normally have gone to hear and gave her a new impression of mathematicians. Because a presentation involves higher-level mathematics does not mean that elementary teachers will not be interested or stimulated. On the other hand, however, comments from high school teachers have indicated that they would not be as open to attending a talk about mathematics in the elementary grades. The real challenge to making the K-12 collaborative work seems to be that of developing teacher awareness of what they can learn from each other across grade levels. The collaborative is making some progress in achieving this.

### F. Next Steps

The Summer '90 Institute of the San Francisco Math Leadership Project, scheduled for June 25-July 19, marks the beginning of the seventh year of the project. The year-long schedule of activities will include an intensive four-week summer institute, monthly meetings, on-going classroom support, and reunion activities. Participants will present two workshops at school sites. The collaborative will host a one-week Woodrow Wilson Summer Institute on Mathematical Modeling, which uses mathematics to describe real-world events and to solve actual problems. The Institute is open to all SFUSD high school mathematics teachers who are guaranteed a teaching position in the fall. The San Francisco Mathematics Collaborative will pay $100 of the $125 registration fee. In addition, teachers will attend all five days of the Institute and will receive $300 worth of mathematics materials paid for by the district. Near the end of the summer, one San Francisco collaborative teacher will attend the EDC Teacher Leadership Workshop in Durham, New Hampshire, August 4-11, 1990.

In summer, 1990, fifty 8th-9th grade students will participate in a summer STAMP program at San Francisco State University. There will also be a one week institute for teachers from the five high schools that are participating in STAMP--three former STAMP schools and two joining the project. In 1990-91, the STAMP project will continue to receive increased financial support from the SFUSD, in addition to the support it currently receives from Citicorp.

Hitachi is providing the Exploratorium with funds to publish and distribute worksheets that were developed two years ago by collaborative high school teachers who had participated in a summer institute and an independent study program at the Exploratorium. The worksheets were developed to demonstrate the applicability of their research to classroom projects. These teachers will work during summer of 1990 to refine the curriculum they previously developed, revise the worksheets, and discuss distribution.

The collaborative is providing stipends of $12-$50 per hour to enable teachers to continue to meet during the summer of 1990.

Discussion regarding an Exploratorium Institute for the 1990-91 school year has begun and funding has been requested from the FUND for the 1990-91 budget. The Institute will bring K-12 teachers together to develop a mathematics curriculum using the Science-at-the-Core exhibits at the Exploratorium.

The collaborative has planned a variety of activities for the 1990-91 school year. The 1990 K-12 Kick-Off is scheduled for October 25, 1990, at the Seven Hills Conference Center, San Francisco State University, with Marilyn Burns as the speaker. As an outgrowth of the after-school workshops, the collaborative has began plans for a dinner series the programs of which will focus on the Mathematics Education Reform Movement. During the coming school year, an effort will be made to expand the Cross-Grade Visit Program and to further develop business/school partnerships. The FUND will also lead a fundraising effort to gain additional financial support for 1990-91 collaborative travel grants and activities.

# SUMMARY REPORT:
# TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Twin Cities Urban Mathematics Collaborative during the 1989-90 school year. The detail and level of specificity in this report are designed to provide historical context for the collaborative as well as a record of the current year. The report is intended to be both factual and interpretive. The interpretations reflect the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and document the extent to which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Twin Cities Urban Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the UMC Teacher Leadership Workshop held in Newton, Massachusetts, in August, 1989; the meeting of representatives of all of the projects in Los Angeles in October, 1989; meetings of the UMC Standing Committee in Newton, Massachusetts, January, 1990, and in Washington, D.C., in May, 1990; meetings of UMC project members held during the annual NCTM conference in Salt Lake City, Utah, in April, 1990; communications on the electronic network established by the EDC; survey data provided by teachers; demographic information provided by the school district(s); and three site visits by the staff of the Documentation Project.

# TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

The purpose of the Twin Cities Urban Mathematics Collaborative, as expressed in the original proposal, is to "extend the sense of professionalism among secondary school mathematics teachers, provide for their further intellectual stimulation and renewal, and establish collegial and professional relationships among the teachers and the wider mathematical community of the Twin Cities." During the first and second years of funding, the collaborative worked towards these goals; by fall, 1988, the collaborative had developed to the point that it was ready to direct its efforts toward refining its focus. This included addressing more sophisticated issues in mathematics, becoming more politically involved, extending the project's influence throughout the Twin Cities, and seeking avenues to ensure continuation of the collaborative project beyond the involvement of the Ford Foundation. Five specific steps have been identified to help the collaborative achieve its goals. They are:

1. Involving teachers in activities that help them to exercise more responsibility for and control over their professional lives.
2. Continuing to provide a broad range of mathematical activities that encourage ongoing participation in the collaborative;
3. Expanding the base and scope of industrial involvement;
4. Integrating groups and organizations involved in precollege mathematics education into the collaborative; and
5. Increasing the visibility and the stature of the collaborative in the Twin Cities, specifically within the school districts.

In its proposal to the Ford Foundation in June, 1988, the Twin Cities Urban Mathematics Collaborative proposed a restructuring that would lead to permanence. It is envisioned that by 1992 the collaborative will become incorporated as a 501(c)3, private, nonprofit, tax-exempt organization. The proposal identified five main goals for 1988-89 that remained the goals for 1989-90, when the new structuring was to be initiated. These included:

1. Sponsorship of those organizational components and activities that have been well received by teachers, including the Building Representatives, the publication of the newsletter, the dinner meetings of the Twin Cities Mathematics Society, as well as workshops, meetings on educational policy issues, and special summer institutes;
2. Initiation of the transitional process that will establish a new governance structure;
3. Filling the position of the part-time project coordinator and incorporating the use of volunteer help into the collaborative;
4. Developing and implementing a strategy for fund-raising from sources other than the Ford Foundation; and
5. Initiation of the process of obtaining nonprofit tax-exempt status for the collaborative.

## B. Context

The Twin Cities Urban Mathematics Collaborative (TCUMC) serves the teachers of both the St. Paul Public Schools and the Minneapolis Public Schools. Each of the districts has distinctly different bodies of governance, since they exist not only within different cities, but within different counties. The Twin Cities have a population of approximately 600,000. Of that number, 352,000 live in Minneapolis and 242,000 in St. Paul. Between now and 1993, enrollment in Minnesota public schools will grow faster than the national average, outstripping every other state in the Midwest, according to enrollment projections from the National Center for Education Statistics. Minnesota's projected 6.5 percent increase in K-12 students between the fall of 1988 and the fall of 1993 is almost a full percentage point higher than increases expected nationwide.

The Twin Cities economic picture has been highlighted in a study provided by the Minnesota Department of Jobs and Training. Future occupational growth in the Twin Cities area, coupled with projected employment in 1993, indicates certain education and occupational needs. The fastest-growing occupations (professional, technical, managerial, and administrative jobs) all require education beyond high school. A college education will not guarantee a job in the 1990s job market, but will put the applicant in the running since employers will be able to pick and choose applicants for jobs that did not formerly require a college degree. Employment in the Twin Cities is projected to grow from 1.3 million to 1.5 million, a 14 percent gain, between 1986 and 1993. Minnesota will show slower employment growth, 11 percent, overall.

Following a state and national trend, the service sector will show the most rapid growth, with business services such as temporary help agencies and computer and data processing services the fastest-growing groups within the sector. Job categories that are expected to grow the fastest will not necessarily be those that account for the largest percentage of the job market. For example, computer programmers and aides accounted for 10,090 people in the area in 1986, with a projected need of 13,590 by 1993. Retail sales will add the largest number of jobs, with an increase of 22 percent by 1993. The managerial occupations in finance, personnel, purchasing, marketing, advertising, and public relations are expected to grow rapidly because of the increasingly complex nature of business operations.

Desegregation of Twin Cities schools has been in process since 1960, but shifting populations and enrollments have slowed progress. The requests of the Minnesota Department of Education to fund cross-district programs were rejected by the Legislature in 1989-90. Instead, Minnesota's open-enrollment program was considered to be the factor that would lead to student exchanges between cities and suburbs, thus stabilizing school ethnic populations. So far, however, open enrollment has not served as a stabilizing factor, according to a report released by the State of Minnesota. Ninety-five percent of the 3,218 students who transferred to other districts during the 1989-90 school year are white. Nine percent of the state student K-12 enrollment is minority; however, only 5 percent of the enrollment-choice group are members of underrepresented groups. Minnesota has struggled with the task of defining the problem of desegregation, which in turn has caused a delay in providing a solution to the problem.

As population increases and shifts occurred, other community and social problems have surfaced that need to be identified and resolved. The number of homeless adults using Twin Cities shelters has increased 16 percent since 1988, while the number of homeless children remained stable according to a report from the Wilder Foundation. Eight hundred-eighty adults and 154 children were identified in 18 metro-area shelters in February, 1990. Fewer women with children are entering the shelters, but those who come have a greater number of children, particularly preschoolers, than in the past. Welfare authorities estimate that one in six Minnesota children live in poverty.

Ethnic population shifts in the Twin Cities area are revealed in school reports. During the 1988-89 school year, an increase in the number of nonwhite students was reported in the Twin Cities. Underrepresented groups accounted for 47.5 percent of enrollment in Minneapolis schools and 39.4 percent in St. Paul schools. In the suburbs, ethnic groups represented 5.5 percent of total enrollment in the 1988-89 school year. That figure is up from 3.7 percent in 1981. Based on 1988-89 figures, Minneapolis and St. Paul schools educate 14 percent of the region's 296,000 white students, but 68.5 percent of the 47,000 minority students. Suburban schools educate 86 percent of the white students and 31.5 percent of students from ethnic minorities in the seven-county area.

Ethnic enrollment in Twin Cities area public schools in 1989 was higher than in 1988, with Asian student enrollment growing the fastest, according to Metropolitan Council reports. The total ethnic student enrollment grew by 2,972 in the 1988-89 school year, a 6.8 percent jump from the previous year. The region's ethnic students numbered 47,000, comprising 13.7 percent of the region's total school enrollment in 1988-89. In Minneapolis almost half the enrollment comes from this population and in St. Paul just under 40 percent are from non-white ethnic groups. Of four ethnic groups, Asian enrollment rose the most, up a record 10 percent from 1987-88, to 16,104 students. African-American students made up 6.2 percent, or 21,350 students, of the region's total enrollment. Asian students accounted for 4.7 percent. For the first time since ethnic enrollments have been tabulated, Hispanic enrollment exceeded American Indian enrollment. Hispanic students increased by 4 percent, to a total of 4,815, while American Indian enrollment grew 1.2 percent to a total of 4.731. Most gains in racial-ethnic groups occurred in the two central cities, which account for nearly 69 percent of the region's underrepresented students.

Present and anticipated changes in the local economy as well as population shifts and composition have created a new series of challenges that Minnesota, including the Twin Cities, school districts must address within the education environment. New burdens on schools in the 1990s will key on racial balance, special education, the viability of small school districts, the need to replace aging and dangerous school buildings, the length of the school year, and curriculum decisions.

## Minneapolis Public Schools

Minneapolis Public Schools (MPS) serves a metropolitan population of 352,000, making it the largest school district in Minnesota. The MPS Board of Education has seven elected members, who voted in July, 1989, to raise their monthly salary to $800, plus an expense stipend of $175 a month. Two board seats were open for election in November, 1989. Superintendent of Schools Dr. Robert Ferrera, former superintendent at Grand Rapids, Michigan, came to Minneapolis in August of 1988. He was given a three-year contract with an annual salary of $89,500. Superintendent Ferrera has formulated proposals for streamlining the Minneapolis school system, based on recommendations of the 60-member Futures Committee, composed of parents and district personnel. Discussions centered on building, program choice, and grade organization issues. Dr. Ferrera's recommendations reflect the consensus of that group. One of the proposals included creation of a K-12 school for American Indian students. An additional school to be built in northeast Minneapolis would emphasize mathematics-science-technology. Dr. Ferrera has made public a commitment to the principle that school administrators should be familiar with real-life aspects of teaching and has set an example by co-teaching a communications class at Minneapolis's Roosevelt High School for one trimester. An English teacher, he has taught for part of each year since he became superintendent.

District expenditures for the 1989-90 school year were $180,400,000. Four percent of the funds are provided by the federal government, 40 percent by the State of Minnesota, 55 percent from local sources, and 1 percent from other sources. The Minneapolis Board of Education has projected a 1990-91 budget of $198,200,000. That is $12,800,000 more than the $185,400,000 budget for 1989-90. Coinciding with the budget increase is a 4.6 percent inflation rate over the past year and a projected 2 percent enrollment increase next year--from 40,127 students to 40,976. The district will also attempt to build a reserve fund at the rate of $1,000,000 per year in order to regain its former credit rating. While Minneapolis is experiencing reductions in the number of secondary education teachers, there are increases in teaching positions at lower levels, with a slight overall net increase in teachers. A proposed referendum in the fall of 1990, for increasing taxes in the Minneapolis district, would decrease the number of students per classroom. Current maximums are 28 pupils per teacher in kindergarten, 30 in grades 1-3, 32 in grades 4-6, 30 in grades 7-8, and 33 in grades 9-12. This referendum did pass.

Minneapolis Public Schools will ask for help with the cost of implementing desegregation. Every program in the district is impacted by the district's efforts to meet the state guidelines for desegregation. In 1989, Minneapolis received a $7,300,000 state grant for desegregation. The district also levied $3,400,000 in taxes to cover desegregation costs and was given the authority to seek an additional $3,400,000 under a rule-compliance levy. Minneapolis's 1989-90 desegregation costs (including transportation and federal magnet proposals) totaled $27,700,000. The district received $25,900,000 in federal, state, and local revenue last year. MPS will seek additional bonding authority to address facilities and materials needs. Nearly 50 percent of the district's buildings are over 60 years old; the last new school was built over 14 years ago. It is estimated that it will cost at least $48,000,000 to bring school facilities up to standard for normal maintenance.

There are a total of 60 schools in the MPS: 7 senior high schools (grades 9-12); 6 junior high schools (grades 7-8); 45 elementary schools (grades K-6), and 2 other (a post high school and Work Opportunity Center). In Minneapolis, high schools offer specialties in mathematics, science and technology, liberal arts, visual and performing arts, and an International Baccalaureate. The city schools began an open-choice policy in 1982. Two MPS high schools, because of their magnet emphasis, have been accused of draining talent from other schools in the district. New programs in mathematics, science and technology, arts, and broadcasting were established at North High, while South High inherited the open school and liberal arts magnet program from two closed schools. During the 1988-89 school year, South High had 14 National Merit Scholars, more than any other Minnesota school and twice as many as the other six city high schools combined. A new two-year federal grant will allow creation of additional programs, including a medical magnet school and a teaching specialty school in the district.

In the fall of 1989, districtwide enrollment was 42,695, the highest since 1979 (21,863 male; 20,832 female). Unexpectedly high elementary enrollments (24,497), the greatest since 1977, prompted MPS to hire several new elementary teachers. Overall enrollment in nonpublic schools in Minneapolis decreased about 2 percent during 1989-90, from 8,282 students in 1988-89 to 8,114 (19 percent). Concomitantly, public school enrollment increased 2.7 percent. In addition, approximately 2,000 students who live within the city attend private or parochial schools outside city limits.

Approximately 2,850 (K-12) students in MPS, classified as Limited English Proficiency (LEP), are served by the current LEP project. To meet the needs of the growing Asian community in Minneapolis, nineteen schools will have LEP Centers next year (up from 14 this year) when the number of students is expected to reach 3,000. The largest group of LEP students are Hmong, followed by Lao, Vietnamese, Cambodian, Spanish, and Russian/Ukrainian. Another growing population from mainland China speaks Mandarin Chinese. Five hundred-sixty LEP students are in grades 9-12.

The districtwide ethnic population for 1989-90 was: white, 50 percent (20,176); black, 30.7 percent (12,405); Asian, 9.9 percent (4,001); American Indian, 7.5 percent (3,016); Hispanic, 1.9 percent (771). Of the total school population, 16,553 students received free lunches, and 2,005 received reduced-cost lunches; at the elementary level, 11,666 students received free lunch and 1,444 received reduced-cost lunches. Approximately 33 percent (13,478) of all students in MPS are from families receiving AFDC.

High school enrollment in 1989-90 was 10,635, with 1,864 students in the technical school. During 1988-89, 6,875 students were enrolled in mathematics courses. The distribution by ethnic groups of district students taking Geometry, Algebra II, Mathematics Analysis, and Calculus for 1988 were: white, 61.7 percent; black, 24.2 percent; Asian, 8.8 percent; American Indian, 3.6 percent; and Hispanic, 1.8 percent. Approximately 62.5 percent of females enrolled in the district take some combination of the listed mathematics courses. MPS will offer Restructuring Mathematics and Science for Students of Color workshops throughout June and July 1990.

The dropout figure for the 1988-89 school year for grades 7-12 was 2,091 students, or 11.2 percent on a cumulative basis. The percentage jumped to 15.8 for grades 9-12 and was maximal at 20.1 percent for grades 11 and 12. The reason most often stated for dropouts was "Quit school after compulsory age because of school problems." White males accounted for the highest dropout figures at 529 dropouts in 1988-89, followed by 403 black males. American Indian females accounted for 109 dropouts, Asian females for 44, and Hispanic males for 25.

High school graduation requirements include two years of mathematics and successful completion of a benchmark test. Approximately 50 percent of the students who graduated continued with postsecondary education.

The CAT (California Achievement Test) battery was administered to sophomores districtwide in April, 1990. Median percentiles ranking revealed an average of 61 in vocabulary, 56 on reading comprehension, 55 on mathematics computation, and 60 in mathematics concepts.

Minneapolis student scores on standardized tests in 1988 dropped after the introduction of new tests. Mathematics scores in grades 7, 8, and 10 were above national averages on the 1985 version of the CAT. Last year, district testing officials in Minneapolis said they expected most scores to decline as much as 15 percentile points as a result of using the new tests. Also reported were MPS scores on the Preliminary Scholastic Aptitude Test (PSAT), the test that helps determine National Merit Scholarship winners. Mathematics scores increased from 46.1 to 46.4, higher than the national average of 45.6

A six-week summer school, made possible by a grant of $296,000 from the city of Minneapolis, enrolled 1,309 students, many of whom had failed to pass tests in reading and mathematics that are used as benchmarks to determine readiness for grade promotion. Fifty percent of the students who had failed the tests earlier were able to pass them after completing summer school. In the summer of 1991, the Board plans to provide remedial education for about 3,000 students and enrichment programs for another 3,000.

Starting in the fall of 1990, students will need at least a C average to participate in extracurricular activities in the Minneapolis schools. The C average must be earned in the grading period just prior to their extracurricular participation.

There are approximately 2,700 teachers in the Minneapolis Public Schools. Forty-five males and twenty-one females teach high school mathematics. The teacher population by ethnic group is: 63 white, 1 black, and 2 from other ethnic groups. Fifty-five high school mathematics teachers have tenure. On the junior high school level, 43 teach mathematics (16 males and 27 females). The ethnic population of mathematics teachers is: 38 white, 1 black, 3 Asian, and 1 American Indian. Thirty-seven of the junior high school mathematics teachers have tenure. Of the 5,508 total MPS school staff, only 807 (14.7

percent) are members of an underrepresented group. Approximately 50 percent of the student body can be designated as part of underrepresented groups while only 12 percent (approximately 325) of the teachers are from diverse cultural groups.

The Minneapolis Federation of Teachers is the bargaining agent for the district's 2,700 member teachers. Negotiations on the 1989-91 contract for Minneapolis Public Schools' teachers went to private mediation in order to facilitate negotiation. The state requires school districts to settle teacher contracts by January 15 of the contract year, or lose $25 per pupil in state aid. The contract was approved in December, 1989, and will bring teachers a 9 percent wage increase over the next two years. The MPS associate superintendent for human resources stated that filing for mediation seemed prudent since negotiations started late in the year. Salaries for MPS teachers for the 1989-90 school year started at $21,015 for those with a BA and reached $46,766 for those with a doctorate and 25 years of service. A salary average was approximately $35,000. Under the next contract, average salaries will jump to $39,500 by 1990-91, from a minimum of $22,192 (BA) to a maximum of $49,273 (doctorate and 25 years experience). The contract includes 184 school days.

Minneapolis has become an incubator of new ideas in education. Minneapolis schools will open a Montessori classroom in the fall of 1990 to serve the children of employees who work at the Target Stores' downtown headquarters, thus creating the district's first "corporate classroom." The classroom will accommodate 25 students in K-2 and two teachers. Child care before and after school will be provided.

A family mathematics program was begun at Folwell Junior High School in Minneapolis for students and their families. The program, funded through the EQUALS Project at the Lawrence Hall of Science at the University of California-Berkeley, is designed to promote the use of mathematics in everyday life.

The Minneapolis Public School Academy is a three-year experiment to test the effects of small class sizes, teacher participation in decision-making and parental involvement in school performance. There are no more than 14 students in each class of the K-5 program, about half the number in most Minneapolis classrooms. The school, with 168 students, is financed in part by a $350,000 grant from the General Mills Foundation. On the strength of first-year test scores, the Foundation has proposed that the project be tested next year in an existing elementary school to see if the results can be duplicated. David Nasby, director of community affairs and vice president of the Foundation, noted that student improvement in mathematics computation was significant.

New ideas for school environments and learning approaches have led to the establishment of other experimental schools. Chiron Middle School, an experimental school situated on the University of Minnesota's St. Paul campus, is supported by area business and industry. Its grade 5-8 students are educated at several sites around the Twin Cities area rather than in a single conventional school building. Parents and teachers are involved in the management of the school, and the curriculum is centered around individualized learning plans and multi-age groupings. Students enrolled in Chiron have the advantage of hands-on experience in the areas of science and technology, business, law and government, and visual and performing arts.

New American Indian centers at Anderson and South High School reflect Minneapolis's efforts to improve education for American Indian students and respond to the demand for an all-Indian school. Unlike St. Paul, which will open a new school in 1990 designed to meet the needs of Indian students, Minneapolis has located its Indian centers within existing programs. About one-quarter of the district's Indian students (670) are enrolled in those programs. At South High School, a mathematics teacher said he has more Indian students progressing toward credit in his algebra class now than he has had in years.

Seven Minneapolis teachers received 1989-90 Minnesota Mini-Grants for innovative projects to teach energy, science, and mathematics. Each winner received $250 for materials and a $50 honorarium from the sponsor, the Minnesota Environmental Sciences Foundation, Inc. The Ashland Oil Company received thousands of nominations for the Teacher Achievement Awards of $2,500 available for 10 Minnesota teachers. Teacher nominations came from students, parents, and other educators.

Vicki DeVoss, Minneapolis Work Opportunity Center, is the latest Minnesota recipient of the Presidential Award for Excellence in the Teaching of Mathematics. De Voss, a teacher in a school that serves high-risk students, commented, "I am pleased that I can represent the fact that Minnesota is concerned about all the students, not just the highest achievers." On the state level, Vicki DeVoss, Marlys Henke of St. Paul Central, and Arnie Cutler of Moundsview were selected as Presidential Awardees. A dinner in their honor was organized by State Department Consultant Judy Halvorson.

Sally Sloan, a Minneapolis Edison High School teacher, received the 1989 Outstanding Education Instructor Award from the International Association for Computers in Education (IACE). Ms. Sloan serves on the IACE Executive Board and is a former president of the Minneapolis Math Club, the Minnesota Council of Teachers of Mathematics, and the National Council of Supervisors of Mathematics.

### St. Paul Public Schools

The St. Paul Public Schools (SPPS) system is the third largest in the State of Minnesota, serving a population of 272,000. Seven elected members serve on the Board of Education, which meets twice a month. Board members are elected for a two-year period. Since 1984, Dr. David Bennett has served as the superintendent of the district at an annual salary of $86,468. Dr. Bennett has announced that he may consider job offers in other states, citing as a cause for his dissatisfaction his disapproval of a Minnesota state law that governs superintendents' salaries. Minnesota law limits salary and contract length for superintendents. Salaries are limited to 95 percent of the Minnesota governor's salary which was $99,000. Dr. Bennett has been praised publicly for his work on promotion of open enrollment and the increase in the number of district magnet programs.

In the 1970s, St. Paul began desegregating its schools. By gerrymandering school attendance boundaries and using magnet schools to draw children from throughout the city, the district has been able to avoid forced busing. To achieve desegregation in the metropolitan area, a city-suburban teacher exchange began in 1989-90 and will continue through 1990-91. The 1990 Legislature appropriated $200,000 for use by suburban districts to assist in urban and desegregation plans.

SPPS expenditures for the 1989-90 school year were $215,139,400. During May, 1990, the St. Paul Board of Education met regarding the 1990-91 budget. The district expects to be $11,000,000 over budget during the 1990-91 school year because of higher teacher salaries and a reduction in state revenues. As a budget-trimming measure, approximately 142 employees will be at risk of layoff, 95 of them teachers. Elementary and secondary class sizes will be increased to a 1:28 ratio on the elementary level and a 1:33.5 ratio on the secondary level. The per pupil expenditure is $4,286, contrasted with the state average of $4,243.

There are 57 schools in the district: 40 elementary schools (K-6); 8 junior high/middle schools (grades 7-8); 6 senior high schools (grades 9-12); one open school (grades K-12); one alternative school (grades 7-12), and one post-secondary technical college. Of the total district student enrollment of 34,585, 12,911 are in high schools. St. Paul schools experienced a burst in enrollment to 34,350 in September, 1989, 155 more students than the district had projected. For example, one school designed for a 600-student capacity had an enrollment of 900. Once a school has met its racial quotas, other schools in the district must be utilized to achieve further racial balances.

Student ethnic populations for St. Paul schools during 1989-90 were: white, 60.4 percent (20,889); black, 15.7 percent (5,430); Asian, 16.3 percent (5,637); Hispanic, 5.6 percent (1,937); and Native American, 1.7 percent (588). The SPPS ethnic enrollment in 1988-89 represented 39.5 percent of the total student enrollment, climbing in 1989-90 to 42 percent, in contrast to the nearby suburbs which have a 6.4 percent ethnic enrollment. A $1,700,000 program for St. Paul schools, Supporting Diversity in Schools (SDS), has been established to eliminate cultural insensitivity and promote greater success for students from underrepresented groups. The six-year program will encourage cultural and racial diversity within the curriculum and instructional practices of the schools. Program co-sponsors are The St. Paul, F. R. Bigelow, Mardag, and Cowles Media Foundations. The program will utilize the resources of 40 cultural and community groups.

A total of 5,810 students attended senior high schools during 1989-90. Of the total enrollment, 38.12 percent (2,215) are from underrepresented ethnic groups. The largest ethnic population is Asian (970 students), followed by black students (915), Hispanic (224), and Native American (106). Enrollment records in 1988-89 in St. Paul school mathematics courses indicated that 51.3 percent of males and 48.7 percent of the females systemwide took advanced mathematics. The ethnic population for students who took Geometry, Algebra II, Mathematics Analysis, Calculus, and General Mathematics was: white, 60.47 percent; Asian, 16.38 percent; black, 15.72 percent, Hispanic, 5.63 percent; and Native American, 1.74 percent.

Within the total SPPS system, 9,454 students came from families receiving AFDC. The SPPS-computed annual dropout rate for grades 9-12 in 1989 was 12.4 percent, based on the number of students in attendance on October 1, 1989.

Beginning with 1989-90 seniors, students must earn 40 credits and pass tests in mathematics, reading, writing, and language in order to graduate. Although testing scores were not available, the media have reported that many Southeast Asian students are in danger of not graduating from St. Paul schools because of an English deficiency. Asian students who are taking advanced mathematics courses have difficulty passing the word-problem portions of the competence examinations as a result of a limitation in English proficiency.

There are approximately 2,600 teachers in the SPPS. Only 9 percent of the SPPS teachers are from an underrepresented ethnic group, while 42 percent of students are from a culturally diverse background. In response to this disparity, the district allocated $10,000 for the purpose of recruiting new teachers from diverse ethnic groups. Although the pool of teacher candidates from underrepresented groups is larger on a national basis, there is keen competition from other districts to hire these candidates.

Sixty-five percent of the district's professional staff have 12 or more years of experience in education and 41 percent have a master's degree or a doctorate or the equivalent.

In November, 1990, the St. Paul Federation of Teachers, the teachers' bargaining agent, called a strike vote. Teachers had been without a contract since July 1, 1989, when the last contract expired. St. Paul Mayor George Latimer, a former labor attorney, stepped in to assist in negotiating a settlement. A two-year contract was agreed upon, which gave a first-year teacher with a bachelor's degree a base salary of $22,347. The previous salary was $21,423. The average salary in 1988-89 was $32,500 and under the new contract became $34,995 in 1989-90. A 20-year teacher with a master's degree moved up the salary scale from $38,650 to $40,556. Teachers were given an additional personal leave day and mathematics league coaches received a 50 percent raise in their coaching salary, now $1,350, the same as that received by Minneapolis coaches. Class size reductions, a "sticky" issue in negotiations, were not addressed in the contract but a joint committee of district school administrators and union leaders continue to discuss the problem. One teacher who voted against contract acceptance commented, "I work in an inner-city school, and I would gladly have given up a personal leave day to gain a reduction in my student-teacher ratio." At the conclusion of the negotiations, Mayor Latimer commented: "In the end, they [teachers] cared more about the kids and education than their past positions."

Area businesses in St. Paul have become involved in the schools, offering support and incentives in a variety of programs. A new incentive program, Prepare St. Paul, is designed to bolster the basic skills and job readiness of SPPS students. A recent survey of local employers at selected firms found that nearly half of the St. Paul area high school graduates looking for entry-level positions have not mastered the basic skills needed to get jobs. As incentives for better academic performance, employers will offer Prepare St. Paul students tutors, priority hiring for at least 500 entry-level jobs, part-time or summer jobs for those who attend college, and scholarship funds. In the first two years, 850 students will be helped at an estimated cost of $700,000, excluding scholarships.

Classroom space in SPPS has been in short supply. As a result, school officials are considering the purchase of the 71-year-old St. Paul Athletic Club for use as a downtown classroom and physical education complex. The district is looking for more classroom space to alleviate the problem of crowded classrooms caused by increasing enrollment. According to school officials, each of St. Paul's elementary schools is at or above capacity and there is no additional space in most buildings to create new classrooms.

The Saturn School of Tomorrow, opened during 1989-90 in temporary quarters, drew 162 students of all abilities and backgrounds from 30 city schools. The basic curriculum is similar to that of other schools, but is enhanced by computer software. Electives are developed by staff and student interest. Field trips have evolved into continuing partnerships with the Science Museum of Minnesota, The Minnesota Museum of Art, the St. Paul Public Library, and the YMCA. Saturn serves students in grades 4-6, but makes allowances for differential reading and mathematics ability. Students range in reading and mathematics skills from 1st- to 12th-grade levels. Future plans for the school involve expansion to include 7th-grade.

Funding for SPPS has become more complex due to shifting tax structures. Under the new tax law passed by the state legislature, St. Paul will get $6,500,000 less in state aid than it expected in 1990. The cut, if approved, requires a 14.5 percent increase in the city's property tax levy, from $64,000,000 in 1989 to $74,000,000 in 1990.

## State Initiatives in Education

A variety of activities on the state level during 1989-90 made an impact on mathematics education. Governor Rudy Perpich appointed citizens to a task force that will assess ways to upgrade mathematics and science education in Minnesota. The task force is charged with reviewing state and federal efforts to improve mathematics and science education, to conduct an assessment of existing mathematics and science programs in state schools, and to study the feasibility of a state mathematics and science school. The task force is also looking at the integration of international education and world languages with the study of mathematics and science. Among those named to the task force are Ruben Soruco of Minneapolis, a mathematics teacher at Highland Junior High School in St. Paul, and Connye La Combe, of Cleveland Junior High School also in St. Paul. Both teachers are members of the TCUMC.

An extensive tax proposal that would provide extra state money to schools was announced by Governor Perpich in 1989. The State of Minnesota will pick up nearly 70 percent of the cost of elementary and secondary public education. Education experts have expressed concern that additional state aid for schools would be coupled with increasing restrictions on the ability of local districts to go to their own voters for referendums or bond issues.

A hearing on proposed changes in state-mandated course offerings in secondary mathematics was held in October, 1989. The proposed changes, supported by representatives of the Minnesota Council of Teachers of Mathematics, stipulates that schools must offer one course each in Algebra I, Geometry, and Algebra II, and at least one Advanced Topics course. The State Board of Education will make the rule official in the 1990 session. The outline of course objectives is patterned after the NCTM *Standards*.

Governor Perpich also endorsed a plan to locate a mathematics and science academy for high school students on an abandoned college campus in Winona, Minnesota. The academy is among the major education proposals that the governor will take to the 1990 legislature. Perpich has called for a public-private partnership to sponsor the school. The proposal also calls for the Hiawatha Education Foundation to buy the buildings and then give them to the state. The school, planned for a total of 400 juniors and seniors who excel in mathematics and science, will include an international studies program.

Northwest Airlines Chairman Al Checchi and former Democratic Floor Leader of the State Senate Emily Staples were appointed to lead an effort to recognize Minnesota students who excel academically. Appointed by Governor Perpich, they will co-chair a task force that will seek pledges to create an endowment for the Minnesota Academic Excellence Foundation (MAEF). MAEF is a public-private partnership created by the 1983 legislature to promote and recognize academic excellence in Minnesota's elementary and secondary schools. It coordinates activities and events for both students and teachers that promote academic excellence. MAEF has also encouraged businesses to become involved in education through its Partners for Excellence Program. The program is designed to stimulate and recognize achievement in mathematics, science, spelling, and geography. Checchi has also pledged to make Northwest Airlines an integral corporate partner in Twin Cities education initiatives and said that as part of the effort he would establish a foundation to support academic excellence. In a speech to Minnesota business and political leaders, Checchi said, "Our highest priority will be to invest in the young."

MAEF in partnership with the Central Minnesota Educational Cooperative Services Unit announced the opening of a new field service office in St. Cloud. Over thirty activities are promoted at the informational service level, including competitions in Knowledge Building, the Academic Decathlon, Odyssey of the Mind, and Math Masters. MAEF also produces a quarterly network newsletter.

The Minnesota Department of Education has been involved in the nationwide effort to reform mathematics education according to the recommendations outlined in the NCTM *Curriculum and Evaluation Standards for School Mathematics*. State Mathematics Education Specialist Judith Halvorson formed working groups organized around different levels of the *Standards*. The working groups met in the fall to propose revisions to the Minnesota Department of Education's Model Learner Outcomes for Mathematics Education, to more closely align the state's model with the *Standards*. Proposed changes include reorganizing learner outcomes to parallel the organization of the *Standards*, rewording some outcomes, and adding outcomes in areas strongly emphasized in the *Standards*. Material from the University of Chicago School Mathematics Project (UCSMP) has been incorporated into curriculums throughout Minnesota. The mathematics program, which was developed under the direction of University of Chicago Professor Zalman Usiskin, is designed to give students real-life problems to solve mathematically, rather than emphasizing "number crunching." Judith Halvorson, who co-authored the advanced algebra book for the project, serves as a mathematics specialist for the Minnesota Department of Education.

The Minnesota Department of Education received a grant from the St. Paul-based Bush Foundation for activities designed to increase the participation of girls and ethnically underrepresented groups in the study of science and mathematics.

**Additional Opportunities for Students and Teachers in the Twin Cities Area**

The Minnesota Mathematics Mobilization ($M^3$) is an organization supported by an NSF grant and co-directed by Dr. Harvey B. Keynes, University of Minnesota, and Dr. Lynn Arthur Steen of St. Olaf College. On January 9, 1990, $M^3$ and the Mathematical Sciences Education Board (MSEB) sponsored a conference, "Mathematics Assessment Issues in the Coming Decade: A Minnesota Perspective," at the College of St. Catherine in St. Paul. The focus of the conference was to develop an action plan for reforming assessment in grades 11-14 at the state level. Topics discussed at the conference included college placement tests, state assessment of high school graduates, prognostic testing for college-bound students, and other tests for the transition years between high school and college. The conference format was equally balanced between keynote addresses by leaders in the field and small group working sessions. Steven Leinwand, Connecticut state mathematics consultant, spoke on "Testing: The Enabling Variable in the Reform Movement." John Harvey, professor of mathematics at the University of Wisconsin-Madison, spoke on "Recent Trends in Mathematics Placement Testing." The conference concluded with an evaluation and panel report. There was no registration fee for the conference and substitute pay was available for participants. The conference was well-attended, with 11 collaborative teachers among the approximately 150 participants.

In February, 1990, approximately 50 mathematicians gathered at Macalester College to discuss a report prepared by $M^3$ on the state of mathematics education in Minnesota. The report, which was produced with a $50,000 grant from the Exxon Corporation, consisted of a collection of papers by experts concerned about mathematics education in Minnesota. The purpose of the report, which found Minnesota lacking in everything from the enrollment in advanced high school mathematics classes to the qualifications of mathematics teachers, is to make leaders in the state aware of the problems in the educational system and to provide information to organizations that can change the system. After reading the report, Ettore Infante, Dean of Minnesota's Institute of Technology, commented, "Math should have the same attention as drugs and AIDS."

$M^3$ and the Minnesota Council of Teachers of Mathematics (MCTM) co-sponsored a Leadership Conference on April 26-27, 1990, in Brainerd, Minnesota. The conference focused on new approaches of assessing and evaluating student performance in mathematics. In the keynote address, Dr. Jan de Lange of the University of Utrecht, The Netherlands, presented research findings on assessment conducted at the Center for Science and Mathematics Education at the University of Utrecht. Conference participants were given the opportunity to design open-ended mathematics problems as well as to explore alternative scoring techniques.

The local and state professional mathematics societies also offer a variety of opportunities for professional development for mathematics teachers in the Twin Cities area. MCTM co-sponsored a one-day fall meeting with the Minnesota Science Teachers Association (MSTA) during the annual Teacher's Convention, Friday, October 20, 1989. The theme of the conference, which was held at Normandale Community College in Bloomington, Minnesota, was "Standards and Deliver." The keynote speaker was Brand Griffin of the NASA Space Center who spoke on the topic, "The New Frontier." Three TCUMC teachers presented sessions at the conference.

The Minneapolis Math Club, an organization comprised of elementary and secondary teachers, is the local affiliate of the National Council of Teachers of Mathematics (NCTM) and the Minnesota Council of Teachers of Mathematics (MCTM). On November 8, 1989, the Minneapolis Math Club sponsored a scavenger hunt at the Awarehouse, the Children's Museum at Bandana Square. After the scavenger hunt, Math Club members had an opportunity to explore the museum. Several teachers from the TCUMC participated in the event. On February 15, 1990, the Minneapolis Math Club sponsored a reception and dinner to honor retiring mathematics supervisor and teacher, Ross Taylor, and to pay tribute to him for his many years of service to the Minneapolis Public Schools. Over 500 people attended the celebration, which was held from 4 to 12 p.m. at Calhoun Beach Club. Mathematics teachers and students from all educational levels presented a program to honor Dr. Taylor's accomplishments and his numerous contributions to the field of mathematics.

The Minnesota Educational Effectiveness Program (MEEP), begun in 1983, is a site-based management program designed to enhance the influence of parents and teachers in school decisionmaking. The program uses the latest in educational research to train principals, teachers, and parents from more than 500 Minnesota schools in group decisionmaking, cooperation, goalsetting, and building a vision of what a school can be. Richard Mesenberg, manager of the Minnesota Department of Education's Office of Educational Leadership, said of the program, "One description may be that the best way to manage a school is as a collaborative effort . . . it's principals and teachers making decisions together, with dispensation to do so from the school board and superintendent." The program is sponsored through state funds.

Minnesota has a Post-Secondary Enrollment Option Program that allows high school juniors and seniors to take college courses at state expense. Students can get dual high school and college credit, making it possible for full-time students to leave high school with the equivalent of two free years of college. A first-year assessment showed that students averaged A's and B's in their college courses and that 95 percent were satisfied with their experiences.

A coalition of Minnesota companies awarded $36,500 in grants to fund innovative short-term programs in Twin Cities school districts. The awards were made in January, 1990. Education Venture Inc. (EVI) awarded grants of up to $500 each to more than 100 area teachers looking for funding for special programs and support of curriculum. A spokeswoman for the MPS said the grants are a great way to support teachers' enthusiasm and recognize their efforts. An example of a program funded by an EVI grant is the study of the basics of genetic engineering at Washburn High School. The chairperson for the EVI grants said that they were designed to help students in acquiring a wide range of skills, from critical thinking skills to mathematics skills. The EVI grants, now in their sixth year, are funded by 40 companies, including ADC Telecommunications, Inc., Graco, Inc., H.B. Fuller Co., Honeywell, Inc., Dain Bosworth/Inter-Regional Financial Groups, and the Unisys Corporation.

Former football star Alan Page, Assistant Attorney General for the State of Minnesota, was admitted to the Football Hall of Fame in 1988. Shortly after his induction, he and some friends set up the Page Education Foundation. The Minnesota Vikings football organization provided proceeds from a game as seed money for the Education Foundation. The Foundation provides high schools seniors from the Twin Cities with financial assistance to continue postsecondary education.

Dale Hulme, a TCUMC mathematics teacher, has developed New Directions, a Youth Ministry. Named "Minneapolis Person of the Year," Hulme is marketing a professional development workshop--Powerpacking Your General Math Classroom with *Fastmath* (computer software).

A year-old program known as FANS (Family Advocate Network System) is part of Pillsbury United Neighborhood Services. It is a special McKnight Foundation program dedicated to breaking the cycle of poverty by helping students stay in school, off drugs, and child-free until they graduate.

Marlys Henke, a state Presidential Award Winner for Mathematics Teaching and an officer in the MCTM, served as the contact for registering Minnesota Junior High School Mathematics League teams. The League runs from September through January. A team consists of six students and alternates; the cost for one team is $100 and for two teams $125 for six mathematics meets. In 1989-90, 75 schools with 107 teams competed in 13 divisions in Minnesota.

Several special summer programs will be available to students and teachers in the Twin Cities area during the summer of 1990: Augsburg Computer Camp (June, 1990); Summer Mathematics Institute, Macalester College (July-August, 1990); Light and Vision--Life as a Scientist (June, 1990); Institute in Algebra, Gustavus Adolphus College (June, 1990); Twin Cities Institute for Talented Youth, Macalester College; the University of Minnesota Talented Youth Mathematics Program; and the Problem Formulation/Solving through Data Analysis Institute (June, 1990).

Carleton College is conducting a summer academic enrichment program for teenage students of color. They will explore literature with Professor Harry Williams and complex mathematics with Professor Mark Krusemeyer. The four-year old program involves youths, from moderate and low-income families in the Twin Cities, who have been identified as having college potential. One student commented on her week at Carleton: "Some of it has been fun and the math is interesting. I'm even more sure now I want to go to college."

The first Summer Mathematics Institute, cosponsored by MAEF and funded by a $30,000 contribution from Unisys and the Math League, will be offered in July, 1990, at Macalester College. Fifty students who will be entering grades 9 and 10 in the fall of 1990 were sought to participate in the residential institute. Students will participate in sessions, create articles, and use their skills at Unisys. There will be no charge to participating students.

## C. Development of the Collaborative

In 1989-90, the Twin Cities Urban Mathematics Collaborative completed its second year of a four-year permanence plan that is to guide the collaborative in creating a permanent structure. The main decision- and policy-making body of the collaborative is the Governing Board. The director for the collaborative, Steven Watson, is chair of this group. He is the executive director of the Minnesota High Technology Council and represents the Council on the Governing Board as well as serving as collaborative director. The Building Representatives, comprised of one teacher representative from each of the junior high and senior high schools in the two cities as well as some private school teachers, is the major contact for teachers with the collaborative. This group serves as a means of communication with teachers, makes recommendations to the Board, advises the Board, discusses issues, and plans collaborative activities for teachers. The chair of the Building Representatives serves on the Governing Board.

Mathematics Professor Dr. Harvey Keynes, who directs the Special Projects Office of the Mathematics Department at the University of Minnesota, provides administrative direction for the collaborative. His official capacity in the governance of the collaborative is as the treasurer of the Governing Board. The collaborative is administered through the Special Projects Office at the University of Minnesota. Dr. Phillip Carlson, working part-time for the Special Projects Office, continued to perform some of the coordinator's duties through August, 1989. The process of developing a job description for the coordinator and advertising the position began during the summer of 1989. Three people were interviewed and in October one person was offered the position. This person originally accepted, but then in December declined the position. On February 12, 1990, James Whitney was named consultant to the collaborative, to serve as coordinator through June 30, 1990, until someone could be identified who met the qualifications and would be willing to accept the position. Mr. Whitney, an employee of Honeywell, Inc., is devoting some of his time to the High Technology Council. He is a former high school mathematics teacher. The duties of the coordinator include preparing an annual budget and work plan; developing a calendar of events and activities; reporting on activities and projects to the Governing Board; scheduling and arranging for Board meetings and other activities; recording and distributing the Board meeting minutes; overseeing the publication of the TCUMC newsletter; overseeing all TCUMC volunteers and part-time office staff; serving as a liaison between TCUMC members, community organizations, and educational workshop resources; and assisting the Governing Board with fund raising for the collaborative. Gerry Sell continued to serve as the collaborative's on-site observer during 1989-90.

The target audience for the Twin Cities Urban Mathematics Collaborative consists of the nearly 260 certified secondary mathematics teachers working in public, private, and parochial schools within the geographic boundaries of the cities of St. Paul and Minneapolis. Its members also include approximately 50 representatives of business and higher education, as well as others involved or interested in mathematics and mathematics education.

**Governing Board**

The Governing Board began the year with 14 members--4 teachers, 4 representatives from business (including Steven Watson, the chairperson), 4 from higher education (including Harvey Keynes and Bill Carlson), 1 Board of Education member, and 1 school district mathematics supervisor. Another three people were listed on the Governing Board directory as non-participants--the on-site observer, an administrative assistant from the Special Projects Office, and a businessperson. The Board met three times during the year, on October 25, 1989, January 10, 1990, and April 25, 1990. Meetings were held at the Holiday Inn Metrodome on Wednesday evenings beginning at 5:00 or 6:00 p.m. and generally lasting for two and a half hours. Each meeting included dinner. In addition to the regularly scheduled meetings, the Governing Board and Building Representatives met jointly at De La Salle High School on December 12, from 4:00 to 8:00 p.m. to participate in a teacher leadership program presented by people from EDC staff and by teachers who had attended the August Leadership Workshop in Massachusetts.

Attendance at each of the three meetings held during the year ranged from 8 to 12 members. In addition, two to four other people such as the on-site observer, a special presenter, and members of the administrative staff from the Special Projects Office attended the meetings. The chair of the Board prepares the agenda. At its October 25, 1990 meeting, two of the teachers who attended the Teacher Leadership Workshop conducted by EDC gave a presentation on their experience. One member raised a concern with the financial report that had indicated that over three times more funding was being expended for administrative costs than for programming. This member felt that such distribution of funds was inappropriate. Another major agenda item was the unfilled coordinator's position. The Board voted to offer the position to one of the applicants pending approval of the University of Minnesota affirmative action candidates.

On January 10, 1990, the Board was provided an update on the proposal to be submitted to EDC for an outreach grant. A group had worked during the holiday break to prepare a draft of the proposal. Board members were asked to comment on the draft. Steve Watson then made use of these comments in preparing the final draft. The coordinator's position drew discussion because the person who had accepted the position had decided not to take it. Steve Watson noted that he was aware of a person working for the High Technology Council who would be willing to serve in the capacity of coordinator on a consultant basis. The Board agreed to this. One teacher spent time during the meeting giving her view of how some teachers relate to the management of the collaborative and how this relationship needed to be improved.

The last meeting of the Governing Board for the year was held on April 25, 1990. The meeting began with a social hour at 4:30 p.m. A statement on the financial status of the collaborative was presented: This indicated that the TCUMC had an annual expenditure of about $25,000 a year, and that there were adequate funds to operate the collaborative for four years at current rates of expenditure. Since a budget had not been prepared for the future use of these funds, the chair recommended that the Mid-life Review Committee that will be meeting during the summer assume responsibility for developing a budget. At the meeting, it was announced that the outreach grant proposal submitted to EDC had not been approved. EDC did, however, promise $1,000 if TCUMC could get funding from other sources. The Board directed Coordinator James Whitney to apply for Eisenhower funds. The board also voted to submit a grant application to the American Association for Higher Education (AAHE) and an application to the MacArthur Foundation for funds to explore programs that would involve elementary teachers more actively in the collaborative.

The Board voted to reopen the search for a coordinator using the position description prepared in August, 1989. The interim appointment was to extend through June, 1990. Also at this meeting, the names of teachers who sought election to the Building Representatives' Executive Committee were submitted to the Board. Another position was added to the Board, bringing the total Board membership to 15. The new position is to be filled by a teacher, selected by the Governing Board, who preferably has been a Building Representative, has previously served on the Governing Board, and is not currently on the Building Representatives' Executive Board. A fifth position was also added to the Executive Committee, to be filled by a teacher.

Mr. Watson discussed with the Board the need for a mid-life review since the collaborative had completed two years of its four years and seemed headed toward a permanent structure. This group would assess the current state of the collaborative and make recommendations on its future direction. The Mid-Life Review Committee would consist of three Board members (one teacher representative, one higher education representative, and one business representative) appointed by Mr. Watson. Other people would be encouraged to participate in the process if they desired. The committee is to meet three or four times during the summer to prepare recommendations for the Board's consideration by the end of September. Issues that the committee are to consider include the creation of a non-profit corporation, the collaborative budgets for the next two to four years, the relationship between the Building Representatives and the Governing Board, fund-raising, the hiring and duties of the coordinator, tenure of Board members, the future direction and structure of the collaborative, and other issues the group feels are relevant.

The Mid-Life Review Committee appointed by Mr. Watson included Joseph Schumi, business representative and appointed chair of the group, Eileen Aberman-Wells, teacher representative, and Wayne Roberts, higher education representative. This group met for the first time on June 12, 1990. A letter was sent to all of the collaborative participants on June 4 requesting that relevant ideas and comments be forwarded to members of the Committee. The Committee planned to meet several times during the summer.

**The Executive Committee of the Governing Board**

The four-member Executive Committee of the Governing Board met five times during 1989-90, between the Board's quarterly meetings, to conduct necessary collaborative business. The major topic addressed by the Executive Committee at the two summer meetings was the coordinator's position description. The Committee also discussed communication within the collaborative and data collection by the on-site observer, as well as setting a regular date and location for the dinner meetings. At its December 19 meeting, the group discussed the rejection of the coordinator's position by the applicant to whom it had been offered. The process for identifying candidates was reviewed and agreed to be adequate. The Committee also appointed a subcommittee of seven people to prepare the proposal for the EDC Outreach Grant. On February 26, 1990, the Executive Committee met to welcome James Whitney as the new coordinator. The collaborative activities and the publication of the newsletter were reviewed. The Executive Committee commended the Building Representatives for their work on preparing a nomination form for the Building Representatives' Executive Committee. The committee then agreed to establish the Mid-Life Review Committee and set the first meeting for June, 1990. The final meeting of the Executive Committee was held on April

12, 1990. The future Graphing Calculator Workshop and other activities were discussed. The Committee approved the award of up to 16 scholarships of $125 to collaborative teachers attending the July Woodrow Wilson Geometry Workshop, prepared a ballot of the names submitted for the Building Representatives' Executive Committee, and voted to proceed with the mailing of the ballot. In another vote, the group recommended that the proposal submitted to EDC be rewritten and submitted to the State of Minnesota Eisenhower Program. The Executive Committee concluded the meeting with agreement to increase its membership to five by including another teacher.

### Building Representatives

The Building Representatives met once a month during the school year. In 1989-90 the group consisted of 35 representatives, at least one from each of the junior and senior high schools in St. Paul and Minneapolis. In addition, some mathematics teachers from private and parochial schools attended the meetings and met with the group. A total of 43 people were listed in the group's directory, including one district mathematics supervisor. The Building Representatives generally met on Wednesday afternoons from 4:00 to 6:00 p.m. In February, however, they had a Saturday afternoon meeting at the College of St. Catherine to work with a Woodrow Wilson Institute leader on identifying the differences in graphing calculators. During 1989-90, the Building Representatives group was chaired by Ona Lentz, a mathematics teacher at North High School in Minneapolis. Attendance at the meetings during the year ranged from 14 to 27 people, with an average attendance of 19. Most of those who attended were teachers. Sometimes others attended the meetings, such as special invitees, Governing Board members, Ross Taylor (the former mathematics supervisor for Minneapolis), and the collaborative coordinator.

The meetings of the Building Representatives consisted of two parts--one for conducting business and the other for a program. Issues discussed at meetings included budgeting the $3,500 allocated to the group by the Governing Board, communications within the Building Representatives group and with others in the collaborative, planning activities, and the selection of those from the collaborative who would be sent to conferences and meetings. The different programs presented at the meetings included a discussion by a librarian on the advances in electronic storage as applied in libraries; Tom Seidenberg, a Woodrow Wilson Master Teacher, talking on graphing calculators; a business representative and Steve Watson from the Governing Board responding to questions generated by the Building Representatives; and a panel presentation on equity issues by representatives from four different ethnic groups. An election of teacher representatives to serve on the Governing Board and Executive Committee was held in April. A total of 102 ballots were returned. The votes determined which of six teachers would serve on the Governing Board as the representatives of Minneapolis schools, St. Paul Schools, and private schools, and on the Building Representatives' Executive Committee representing the same three constituencies. December's joint meeting of the Building Representatives and the Governing Board, which featured a program on leadership skills, is described in the Activities Section that follows.

## The Building Representatives' Executive Committee

The Executive Committee of the Building Representatives was established in the fall of 1989. This group of six teachers held its first meeting in December. Executive Committee meetings were held nearly every month, prior to the meeting of the entire group. After the April election, three additional members joined the Committee. Meetings were held in the afternoon from 3:00 to 5:00 p.m. The Executive Committee orchestrates plans for the meetings of the larger group, allocates money for collaborative teachers attending meetings, and deals with other issues as they arise.

During the year, the Executive Committee raised some important issues. The major topic of discussion at the December meeting was the invitation to Frank Demana from Ohio State University, instead of to a local teacher, to present a workshop in the Twin Cities on graphing calculators. The Executive Committee agreed that the collaborative should make the promotion of talents from within the group a priority whenever possible. The committee supported the collaborative in submitting a proposal for an EDC Outreach Grant and felt the focus should be on equity. The names of teachers to serve on a writing team were suggested. The January meeting was spent planning the spring schedule of meetings.

The majority of time at the March meeting was devoted to generating questions for the Governing Board chair and for the business representative who were scheduled to attend the Building Representatives' meeting later in the month. The questions raised issues about the differences between the way the Building Representatives group approaches its business meetings and the way the Governing Board conducts its business. Part of the motivation behind these questions was the feeling that the Governing Board was forcing a structure on the operation of the collaborative that was too rigid. The questions raised issues such as: making decisions by consensus or by voting; the selection criteria for determining who could be sent to conferences and who would serve on boards; how the different groups view professionalism; openness in operating the collaborative, with the view that teachers have an open-door policy but business people are viewed as conducting business privately; having mailings approved by the chair of the Governing Board; and determining what the Building Representatives can do on their own and when they need the permission of the Board to act.

The topics discussed at the April meeting focused on the amount of the stipends to be issued teachers for attending the NCTM Annual Meeting and the Woodrow Wilson Workshop, and the election of teachers to serve on the Executive Committee of the Building Representatives. The final meeting for the year was held on May 14. Plans were made for the coming school year. No one had agreed to serve as the chair of the Building Representatives, so it was decided to proceed without having a chair. One teacher was assigned the responsibility for each of the fall meetings. Other topics included the purchase of multicultural materials to distribute to each school and the format for future meetings.

### TCUMC Proposal-Writing Initiatives

On January 25, 1990, the Twin Cities Urban Mathematics Collaborative submitted a proposal to the Education Development Center for an Outreach Action Grant of $10,000. The purpose of the grant was to address the development of special problem-solving and equation-solving skills and techniques by all junior high students, especially female and minority students, if they are to subsequently take higher level mathematics courses. The grant was to provide the opportunity for a group of TCUMC teachers to work during the summer of 1990 to identify appropriate materials emphasizing problem solving, equation solving, and graphing to prepare junior high school students to take higher-level mathematics courses. It would also have required a strong commitment from businesses, especially the high technology business community, to identify and provide female and minority role models for the TCUMC schools.

The grant proposal was designed to reflect the needs of more than 100 TCUMC junior high school teachers. The proposal was written by a specially created TCUMC subcommittee composed of four junior high and one senior high school mathematics teachers and the chair and vice chair of the Governing Board. (The high representation of junior high teachers was based on a recommendation by the Building Representatives.) The subcommittee met on December 27, 1989, and January 5, 1990, to determine the most critical needs for TCUMC teachers and to draft the proposal. The preliminary proposal was presented to the TCUMC Governing Board on January 10, 1990, and sent to the Building Representatives for discussion at their January 17, 1990, meeting. The revised proposal was then reviewed by the Executive Committee, approved, and submitted.

The grant proposal was not funded by the EDC, although EDC did offer to provide $1,000 in funds if other funds could be found to support the proposal. The Governing Board decided to revise the proposal and submit it in response to a request for proposals from the State of Minnesota Eisenhower Title II Awards Program. A preapplication was submitted in May and the final proposal in June, 1990.

TCUMC also developed a proposal in response to a request for proposals from the American Association for Higher Education and the MacArthur Foundation. If funded, the grant would be used to help incorporate elementary school teachers into the collaborative.

## D. Activities

During the 1989-90 school year, the Twin Cities Urban Mathematics Collaborative sponsored a variety of activities for junior and senior high school mathematics teachers designed to enhance professionalism and to create collegial networks among teachers and representatives of business and higher education. The collaborative also encouraged teachers to participate in activities offered by other local, regional, and national organizations and offered financial support to facilitate teachers' participation.

## Twin Cities Mathematics Society Dinner Meetings

When the collaborative was established in 1985, the Twin Cities Mathematics Society (TCMS), initially called the Twin Cities Pre-College Mathematics Society, was formed to organize collaborative functions that would foster professional and social contact between mathematics teachers and mathematicians from the university and business communities. To facilitate the development of TCMS into an independent and self-supporting society, its membership was expanded to include teachers outside the collaborative's geographic boundaries in Minneapolis and St. Paul.

Each year, the society has sponsored a series of successful dinner meetings for collaborative teachers and members of the larger mathematics community. Initially, society dinners were offered free of charge. In 1987-88, however, a fee of $5, half the cost of the dinner, was instituted for collaborative members, while non-collaborative teachers paid the full cost. Beginning in the fall of 1988, all participants were required to pay the full cost of the dinner, which in 1989-90 ranged from $12 to $15.

Three dinner meetings were held during the 1989-90 academic year. The first meeting was planned and coordinated by on-site observer Gerry Sell, with the assistance of the Building Representatives. The second meeting was coordinated by Wayne Roberts, Macalester College. The third meeting was coordinated by Ross Taylor.

### October 12, 1989 Dinner Meeting

The first TCMS Dinner meeting for the 1989-90 academic year was held October 12, 1989, at the Campus Club of the University of Minnesota. In a presentation before dinner, collaborative teachers Ona Lentz and Karin Thul shared their experiences at the UMC Teacher Leadership Workshop they had attended in Boston, August 6-11, 1989.

Only 26 people attended the dinner meeting, including 19 collaborative teachers, the TCUMC director and on-site observer, a school administrator, 2 representatives from higher education, and 2 guests. The poor attendance was attributed to the late mailing of the newsletter that contained the meeting announcement. In addition, the newsletter mailing list had been reduced from 450 to approximately 200, because teachers who had neglected to return a form in the spring of 1989 were removed from the newsletter mailing list. Those who were at the dinner meeting seemed to enjoy it. One teacher commented, "It was a fun dinner--too bad the attendance was so bad." A second teacher said, "I'm surprised we had anyone at all considering when the invitations arrived." The on-site observer reported, "The talk was given before the dinner to accommodate the serving lines since this buffet is so popular. Eating at the Campus Club is a big draw, so the attendance was really disappointing. Karin and Ona did a good job."

### February 5, 1990 Dinner Meeting

The second TCMS dinner meeting was held February 5, 1990, at Macalester College. Prior to the dinner, the college hosted a reception at 5:30 p.m. in Olin Hall to celebrate Twenty-five Years of Mathematics and Computer Science. Exhibits at the reception portrayed the full range of mathematical activity available on the Macalester campus. Participants had an opportunity to visit the newly remodeled facilities, including a computer laboratory. Following a dinner served in the Trustee's Room of the Weyerhaeuser Administration Building, Professor Joseph Konhauser of Macalester College spoke on "Problems I have Enjoyed." Professor Konhauser is the editor of the *Pi Mu Epsilon Journal*, the book review editor for the *Mathematics Monthly*, a respected geometer, and has served on every national mathematics contest committee, including the American Olympiad and the Putnum.

Approximately 60 people attended the dinner meeting, including 31 collaborative teachers and the on-site observer, 5 non-collaborative teachers, 6 representatives from business, and approximately 15 from higher education. Four of the business representatives were former students of Professor Konhauser.

The response to the evening was extremely favorable. One teacher commented, "Nice to meet new faces, especially college-level people. Enjoyed the problems and thinking skills involved. On the other hand, we have calculators. Should we teach these problems? How do I incorporate this into my curriculum?" A second teacher added, "I enjoyed the math, it was a fun talk." A third teacher remarked, "I enjoyed the problems. That is the main thing. Since I haven't come for a while, I enjoyed seeing everyone." A fourth teacher said, "Could never duplicate those problems myself. I really enjoyed this." A fifth teacher added, "Delightful sense of humor, good talk. But, are these the problems we should be teaching?" A business person added, "Delightful--nifty program. Nice to come here. We do need this kind of thing--we need to continue to do this." A professor remarked, "Konhauser can just keep thinking of this stuff. He can think of four or five problems for each one I can think of." The on-site observer reported, "This is a good dinner and meeting. Macalester did a very good job. This was part of a celebration for Macalester and the dinner was one event."

### March 14, 1990 Dinner Meeting

The third TCMS dinner meeting was held March 14, 1990, at the College of St. Catherine. The featured speaker was Dr. Morton Hamermesh, mathematical physicist and former chair of the University of Minnesota Physics Department. As part of his presentation, "Symmetry in Art and Science," Professor Hamermesh shared a variety of slides that illustrated the properties of mathematical symmetry that appear in art and science.

Thirty people attended the dinner meeting, including 14 collaborative teachers, the collaborative director, coordinator, and on-site observer, 3 representatives from business, 8 from higher education, a retired school administrator, and the speaker's wife. The on-site observer noted that although there was a high representation of college faculty present, the overall attendance was much lower than had been anticipated, especially considering the speaker and the site.

### TCUMC Leadership Conference

On December 12, 1989, the Twin Cities Urban Mathematics Collaborative held a leadership training workshop for its Governing Board and Building Representatives. The workshop, which was co-sponsored by the UMC Technical Assistance and Outreach Projects at the Education Development Center (EDC), focused on communications and organizational structure. The goal of the workshop was to help participants understand how to work together more effectively and to plan for the future. A notice had been sent to each school, requesting that either the Building Representative or on-site teacher from the building attend the workshop. A total of 33 people participated in the workshop, including 23 teachers and Mark Driscoll and Janet Daisley from EDC. There was representation from all but 13 schools.

The conference, which was held at De La Salle High School in Minneapolis, began at 4 p.m. with a welcome by Governing Board Chair Steven Watson and Building Representative Chair Ona Lentz, followed by an overview of TCUMC, which was presented by Janet Daisley of EDC, Collaborative director Harvey Keynes, on-site observer Gerry Sell, Steven Watson, and Minneapolis School District Administrator Ross Taylor. The Building Representatives' Executive Committee then presented two recommendations, one regarding the membership composition of the committee during 1989-90, and the other regarding procedures for expenditures by the Building Representatives. Both recommendations were unanimously approved. At 5 p.m., Mark Driscoll of EDC led a session on effective communication in which he stressed the importance of assertive sharing and active listening. Collaborative teachers Marty Gaslin and Karen Thul served as presiders for the session. Prior to beginning the buffet supper and the brainstorming segment of the conference, the collaborative formally commended Gerry Sell for her many contributions to the collaborative. The program concluded with six concurrent brainstorming sessions, each addressing a specific topic: Mathematics Society Dinner Meetings, Program Development, Communications, Finances, Involvement, and A Vision for the Future of TCUMC.

In general, the participants felt that the workshop was very worthwhile, although a few participants expressed concern that not all of the questions regarding collaborative governance had been completely answered. A written evaluation form was distributed on which participants were asked to rate the parts of the workshop as *very worthwhile*, *worthwhile* or *not worthwhile*. On the form, the TCUMC Overview was rated *very worthwhile* by 8 people and *worthwhile* by 12; the Leadership/Communication Session was rated as very worthwhile by 7 participants, *worthwhile* by 12 participants and *not worthwhile* by 1 participant; the buffet and brainstorming parts of the program was rated *very worthwhile* by 13 people and *worthwhile* by 7 people. Comments included: "Good opportunity to meet other teachers and share experiences. I'm excited about the possibilities"; "It's a shame to bring someone in 1,500 miles and not have time for them to do their thing properly"; "I wish I could contribute more--I'm glad I'm involved now. I'm looking forward to future meetings"; "I'm still frustrated that I do not hear what I need to hear. Who is to do exactly what? I'm still looking for the structure"; "Fun evening! Lots of ideas"; "I felt this was extremely well organized. Good job!" and ". . . [T]here is nothing new here, but [the conference was] useful to have. We need brainstorming sessions--perhaps every year or two!"

## Woodrow Wilson Summer Institute for Teachers of High School Mathematics

From July 10-14, 1989, the collaborative sponsored a Woodrow Wilson National Fellowship Foundation Summer Institute at the University of Minnesota. The Institute focused on three themes: teaching traditional topics in new and exciting ways; teaching previously inaccessible topics, now made possible by new technology; and the technology itself--calculators, computers, and powerful software. The topics addressed were related to the concept of function and included numerical methods, geometric approaches to functions, data analysis, linear and non-linear functions, mathematical modeling, and matrix applications. A strong emphasis was placed on exploring and working with new software programs, as well as with the graphing calculator. The use of writing in mathematics and general approaches to problem solving served as guiding principles for the Institute. Throughout the five-day workshop, the concept of mathematics as "a way of thinking" rather than as a body of facts and techniques was stressed.

The Institute was presented by Joan Countryman of Philadelphia, Pennsylvania; Jo Ann Lutz of Durham, North Carolina; Lewis Romagnano of Longmont, Colorado; and Thomas Seidenberg of Yakima, Washington. The four leaders were Master Teachers who had participated in a month-long Summer Institute at Princeton University under the direction of the Woodrow Wilson Fellowship Foundation's "Teachers Teaching Teachers" program. Through this program, some of the best mathematics teachers from across the country receive training to conduct Institutes at selected sites.

Enrollment in the Institute was open to all mathematics teachers in the Minneapolis metropolitan area, but preference was given to collaborative members. Collaborative teachers were eligible to apply for either upper division graduate credits plus a travel stipend or a $100 stipend, with no travel expenses nor graduate credit. In addition, the

$125 registration fee was waived for TCUMC members. In total, 16 collaborative teachers and 11 noncollaborative teachers participated in the Institute.

The Institute was extremely successful. Participants reported that it was very worthwhile and that they learned about practical applications which they could take back to their classrooms. One teacher said, "Terrific. I got things I can definitely use and will use in my classes this year. I'm teaching General Math and I am going to try being creative and do a lot of computer stuff with them (depending on our new principal, of course) but I'm excited. Now if they would just do one of these in geometry. . . ." A second teacher commented, "This workshop was very good. I taught analysis last year for the first time and this workshop fit perfectly with that class. Just seeing the entire year during one week all on the computer was great, although I wish it would have been on the MAC." A third teacher remarked, "It was definitely worthwhile. I'm teaching calculus and general math and I got stuff for both levels." A fourth teacher commented, "Fantastic! The week made a whole lot of sense. Of course, that's the advantage of having people who are doing this every day teaching it. They were so good. I enjoyed every minute, especially that the software had been used by them. You know, when you buy something cold you never know if it will do what you hope. I wish we could have had more time to really learn the programs. Even so, fantastic." A fifth teacher added, "I have never participated in any activity outside my own building before. I am impressed." In an article for the TCUMC newsletter *Pentagon Papers*, Darryl Beissler, a teacher who participated in the Institute, wrote "The Woodrow Wilson Summer Institute on Functions and Technology was a refreshing and practical experience. It was an opportunity to take a 'hands on' look at the math we teach using the new technology. We spent a lot of time in the computer lab learning how to use software packages that are now available. . . .Those of us who attended the workshop received copies to bring back to our home schools. . . . Another highlight of the workshop was learning how to use the HP-28S graphing calculator. The organization of this workshop was excellent. The very full days from 8 to 4 included lunch at the University of Minnesota Campus Club. The day was nicely split up between classroom and computer lab time. I think what makes the Woodrow Wilson Institute so valuable is having instructors who are classroom teachers. The four we had this summer did an outstanding job of presenting what they are practicing in their own schools around the country."

## Follow-Up Meeting

The collaborative sponsored a follow-up meeting for the participants of the Woodrow Wilson Summer Institute on Functions on Saturday morning, February 24, 1990, at the University of Minnesota. Tom Seidenberg, one of the Woodrow Wilson Master Teachers who had presented the Institute in July, led the discussion. Approximately 14 teachers attended.

## Graphing Calculator Presentation

On Saturday afternoon, February 24, 1990, from 2 to 3:30 p.m., Woodrow Wilson Master Teacher Tom Seidenberg gave a presentation on graphing calculators. During his presentation, Mr. Seidenberg compared the features of the Sharp, Casio, Texas Instruments, and Hewlett-Packard graphing calculators and instructed teachers on the use of the Casio calculator. All TCUMC teachers were invited to the presentation, which was held at the College of St. Catherine directly following a meeting of the Building Representatives. Mr. Seidenberg, a mathematics teacher from Yakima, Washington, was in Minneapolis to lead a follow-up meeting for participants in the 1989 Woodrow Wilson Summer Institute.

Sixteen people, including 14 teachers, a representative from higher education, and the collaborative on-site observer, attended the presentation, which was funded by the Building Representatives. The response to the session and to the handouts distributed was very favorable. The on-site observer reported, "This was a very good activity. Seidenberg was an excellent presenter. Marlys had brought a set of Casio calculators from school, so everyone had one."

## Graphing Calculator Workshop

The collaborative sponsored a one-day workshop on graphing calculators Saturday, May 19, 1990, at the Sheraton Hotel. The all-day workshop was conducted by the five Minnesota teachers who had participated in the 1989 Woodrow Wilson Summer Algebra Institute at Princeton University.

The workshop was open to all collaborative teachers, with preregistration accepted on a first come-first serve basis. Each of the 29 teachers who were preregistered for the workshop received a graphing calculator; two teachers who showed up at the door were allowed to participate in the workshop, but did not receive the calculator. Complementary lunch and coffee were served during the workshop, which ran from 8 a.m. to 5:30 p.m.

The response to the workshop was very favorable. The on-site observer reported that with the exception of two participants who rated the workshop a 7 on a scale of 1-10 (with 10 being highest), all of the participants rated the session a 9 or a 10. Teachers were also very enthusiastic in their comments about the workshop. One teacher said, "We should have more stuff like this." A second teacher remarked, "Very good workshop--especially appreciated it given by our own teachers." A third teacher added, "Definitely a #10!" A fourth teacher noted, "I'm so glad I was able to come, one of the best events we've had." A fifth teacher concluded, "Very good--a lot of things I can do with my kids."

## Grants for Calculators

Several collaborative teachers were able to procure outside funding to purchase graphing calculators. Dennis O'Keefe of Edison High School received funding from the Edison High School Booster Club's charitable gambling profits for his school to purchase two classroom sets. Juanita Squires of Central High School wrote a grant proposal to the St. Paul Public Schools and obtained funds for a set of classroom calculators. Eleanor Matsis of North High School used some of the funds she received for winning the 1988 Presidential Award for Excellence in Teaching Mathematics to purchase graphing calculators for each of the North High School mathematics teachers.

## Local, Regional, and National Conferences

### 1989 Woodrow Wilson Mathematics Institute

Five Minnesota teachers, including three TCUMC members, were among the 50 teachers selected out of 1,500 applicants to attend the 1989 Woodrow Wilson Algebra Institute in Princeton, New Jersey. The Institute, which was held July 2-28, 1989, centered on an investigation of ways to improve the teaching and learning of algebra. The participants learned how to use new technology and how to develop curriculum materials. Throughout the workshop, several real-world applications of mathematics were presented which not only challenged the participants' mathematical and problem-solving skills, but demonstrated instructional techniques.

The TCUMC teachers who participated in the Institute reported that it was a most valuable experience, both personally as well as professionally. In an article for the TCUMC newsletter, *Pentagon Papers*, TCUMC teacher Cathy Wick, described her experience at the Institute: "When friends ask about the month I spent at Princeton, my response is, 'A remarkable experience! It changed my life.' I use words like challenging, exciting, intense. Four years of college in four weeks. Forty-nine intelligent, strong, capable individuals brought to one place to live together, to learn together, to learn from one another, and ultimately to create something. . . .The process was as interesting as the product. The group developed during the four weeks, passing through the predictable stages of getting acquainted, seeking direction, arguing, producing, and establishing closure. Each of us brought experience in leadership: each of us learned to compromise. What I learned about myself will be as valuable in the future as what I learned about my subject. I am honored to be a Woodrow Wilson Master Teacher, to have worked and played with a fine group of professionals, many of whom I can now call friends. The end of the Institute was really a beginning; now the work begins in earnest, to carry the 'power of Princeton' beyond the campus."

The Institute staff was so impressed with the teachers from Minnesota that they awarded the Minnesota team a $5,000 grant to conduct two workshops in Minnesota during the summer of 1990. The Woodrow Wilson Institute also provided a $4,800 travel grant for the team to present at the NCTM regional meetings in Madison, Wisconsin, in October, 1990, and in Sacramento, California, in February, 1991, and at the 1991 NCTM Annual Meeting in New Orleans. The team also led a three-hour workshop on Saturday, April 28, at the 1990 MCTM Spring Conference and conducted a graphing calculator workshop for TCUMC teachers in May.

One TCUMC teacher who attended the Institute was selected for Woodrow Wilson traveling teams and will serve as a workshop leader at several week-long workshops throughout the country during the summer of 1990.

## Minicourse on Using the Graphing Calculator in the Precollege Curriculum

The Twin Cities Urban Mathematics Collaborative paid the $150 registration fee for two teachers to participate in a one-day minicourse, "Using the Graphing Calculator in the Precollege Curriculum." The minicourse, which was taught by Frank Demana, a mathematics professor at Ohio State University, was offered from 8:30 to 4:30 p.m. on July 6, 1989, as part of the Conference for Mathematics Reform for College Teachers being held at University of Minnesota. The minicourse featured the hands-on use of graphing calculators as well as instruction based on classroom materials. Each workshop participant received a Casio FGX 7500 calculator and a copy of the textbook, *Precalculus Mathematics: A Graphing Approach*, by Demana and Waits.

The workshop began with the participants learning how to use their new calculators. A great deal of enthusiasm was generated early as the participants became familiar with their calculators. Problems that demonstrated the advantages of using graphing calculators were presented and solved during the remainder of the workshop. Throughout the session the advantages of using graphing calculators in mathematics classrooms were discussed.

The two TCUMC teachers who attended the minicourse felt it was extremely beneficial. One of the teachers said, "This is great. Every teacher should be here. Every teacher should have a graphing calculator. So should every kid. But we know that will never happen out of district funds." The other teacher commented, "It was amazing. I learned so much, but left pained because every kid should have such a tool (graphing calculator) and I know that's not going to happen. But for me it was a terrific experience." In an article about the minicourse that appeared in the collaborative newsletter, participant Steve Lindquist wrote, "The workshop was extremely exciting and informative. With graphing calculators becoming increasingly available to students, I would highly recommend that secondary math teachers attend a workshop similar to this one and become comfortable using graphing calculators."

## Teacher Leadership Workshop

The UMC Technical Assistance and Outreach Projects at EDC sponsored a one-week Teacher Leadership Workshop August 6-11, 1989, at Lasell College in Newton, Massachusetts. The four goals of the workshop were: (1) to provide teachers with basic skills training/development, including communication, negotiation, and meeting skills; (2) to help teachers develop a strategy for effecting local change tied to an issue which is critical to the growth of their collaborative; (3) to provide a forum for teachers to think about their vision for the teaching profession and educational system as a whole; and (4) to provide a foundation for a network of collaborative teacher-leaders. The workshop emphasized two dimensions for being effective as leaders in schools; understanding and communicating with people in an organizational setting and exercising organizational leadership.

EDC sponsored the attendance of TCUMC teachers Martin Gaslin and Karin Thul, paying room, board, registration, and transportation. Ona Lentz was sponsored by the collaborative to attend. Mr. Gaslin reported that the workshop was extremely worthwhile. In an article that appeared in the collaborative newsletter, Mr. Gaslin wrote, " . . . I felt the workshop was a great experience for two reasons. First, as a third year teacher, I learned a great deal about leadership. Many of us have leadership skills that we do not realize we have. Secondly, I gained over thirty-five friends from all over the United States that I will never forget. Thank you EDC and TCUMC for providing me the opportunity to attend this workshop."

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Eight collaborative teachers each received an $80 stipend to attend the 68th Annual Meeting of the NCTM in Salt Lake City, Utah, April 18-21, 1990. Teachers interested in applying for the stipend had only to leave a message to that effect for Ona Lentz, chair of the Building Representatives. All teachers who wanted to go to the NCTM meeting were regarded as eligible for a stipend. The stipends were awarded after the participants shared their NCTM experiences with their peers at the May 9 meeting of the Building Representatives.

The theme of the NCTM conference was "Climbing to New Heights in Mathematics." Mathematics teachers, administrators, teacher educators, researchers, and other professionals from all over the United States and Canada, as well as from countries around the world, convened for the purpose of seeking new heights of professionalism and commitment in mathematics education. During the day, the teachers attended a wide variety of sessions from among the 500 that were offered. On two evenings, the teachers participated in a reception and a working session with members of the other UMC collaboratives from across the country. The reception Wednesday evening and the working session Thursday evening, as well as a follow-up working luncheon on Friday, were sponsored by the UMC Technical Assistance Project. The working sessions on Thursday evening and the luncheon on Friday, which was limited to 25 participants, featured Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts, who spoke on the topic, "Students of Color Through Staff Development."

The on-site observer reported that the participants were pleased to have had the opportunity to attend the conference and that the stipend was appreciated.

## MCTM Spring Conference

The Minnesota Council of Teachers of Mathematics (MCTM) held its second annual spring conference weekend at Cragun's Conference Center in Brainerd, Minnesota, April 27-28, 1990. The theme of the 1990 conference was "Mathematical Connections Throughout Minnesota." A goal of the conference was to help mathematics teachers in Minnesota network professionally and become leaders in activating the national mathematics reform agenda outlined in the NCTM *Standards*. The keynote address was delivered by Thomas Nelson, the new Commissioner of Education for the State of Minnesota. The title of Commissioner Nelson's address was "$(\text{MCTM})^3$ = Minnesota Council of Teachers of Mathematics • Mathematical Connections Throughout Minnesota • Motivation for Changing Tomorrow's Mathematics."

During the sessions on Friday and Saturday, national and state leaders offered a wide variety of sectional presentations. Thirty-four members of the Twin Cities Urban Mathematics Collaborative served either as speakers or presiders at conference sessions.

Collaborative teachers Marty Gaslin, Ona Lentz, and Karin Thul, for example, presented a session: "Networking with the Pros: Learn How to Present Yourself as a Professional by Following the Rules of Networking." TCUMC member and Presidential Award winner Vicki R. DeVoss, of the Work Opportunity Center in Minneapolis, presided at a junior/senior high session on Pascal's Triangle. In addition to having a choice of over 100 sessions, conference participants also had the opportunity to visit commercial displays in the exhibit area. Specific blocks of time during the two-day conference were designated for elementary, junior, and senior high school teachers to visit the exhibit hall.

The conference was extremely well attended, with the number of participants exceeding the previous year's registration of nearly 500. Public and private school mathematics teachers from Minneapolis and St. Paul were eligible to receive up to $75 in reimbursement for expenses from their respective school districts for the conference. Funds were limited, however, and were allocated on a first come, first-serve basis. At a TCUMC Building Representatives meeting, the teachers reported that the MTCM conference was excellent in terms of both quality and quantity.

### Collaborative Newsletter

An important networking component of the Twin Cities Mathematics Collaborative is the collaborative's newsletter, *The Pentagon Papers*. The newsletter, which was first published in December, 1985, under the name "Urban Mathematics Collaborative Newsletter," continues to be a primary source of information for the entire collaborative membership. During the 1989-90 school year, two issues of the *Pentagon Papers* were published by the Special Projects Office in the School of Mathematics at the University of Minnesota, a fall issue and a spring issue. The spring issue, which was prepared by Ross Taylor and Sally Sloan, was designed specifically to promote the accomplishments of collaborative teachers and to provide information about professional opportunities that are available.

## E. Observations

### Project Management

The management of the Twin Cities Urban Mathematics Collaborative experienced some administrative challenges during 1989-90. Major points of stress involved were the coordinator's position, the graphing calculator workshops, and the relationship between the Building Representatives and members of the Governing Board. The source of stress appeared to be related to fundamental issues of collaboration when people from different occupations--each with its own rules, procedures, and traditions--come together to create a joint effort.

On the surface, the collaborative is well structured with the Governing Board having responsibility for determining policies, allocating funds, and specifying the rules for operation of the collaborative. The TCUMC is sound financially and has adequate funds to support the current level of activities for up to five years. The Building Representatives group provides a means for teachers to network and develop activities to meet their needs. The membership roster of the two groups includes four teachers who belong to both. Each group also has its own executive committee with the authority to make decisions for its parent group as the need arises.

However, even though the governance structure has been clearly specified, there is still some lack of trust and an unwillingness to share in decision making by some members of both groups, including a small but vocal group of teachers and the collaborative administration. One contributing factor is that each group has a different perspective on how to make decisions. The administration values following a set process according to which all members of the Board vote on resolutions brought to the Board. The teachers strive more for developing consensus with the expectation that what all agree on will define the action for the group. This variation in governance style helps to highlight differences that are encountered in attempts at collaboration between teachers and representatives of school districts, higher education, and those from the corporate world. Some nonteachers object to consensus as a means of decision making, believing that it does not truly represent a democratic process because less vocal members are not heard nor empowered equally.

The Governing Board operates under a set of by-laws specified by the Permanence Committee. The group of up to 14 members meet around a board table. The meetings are structured, follow an agenda very closely, and limit discussion to the issue at hand. Decisions are made by majority vote. The model employed is most representative of a business meeting that is conducted in a minimum amount of time. The process ensures that decisions will be finalized and that each person in the group has input through voting.

The Building Representatives conduct business, plan activities, share ideas, and hear presentations by trying to reach consensus among members. The up to 35 members who attend the meetings sit informally in a circle or around tables. The agenda lists the order in which reports will be presented. All members are given an opportunity to discuss each item. Decisions are made when those present come to some agreement. In practice, there may be a few teachers who respond to an issue while a number present remain silent. The agreement by those who discuss the issue and the silence of the others is considered consensus. Sometimes decisions or developing plans are delayed until future meetings. What this experience does provide is an opportunity for the teachers to learn more about what is happening in other schools, to gain ideas from each other, and to be involved in decision making.

A small core of the Building Representatives have objected to the structure the Governing Board uses to make its decisions. They believe that the process prohibits full discussion on the issues being decided and that teachers should have more power in decision making. The collaborative administrators point out that the Governing Board was given its authority by the former Steering Committee when it accepted the plan for permanence. Teachers are represented on the Board and as such have a say in making decisions.

Additional factors that are issues in governance are the institutional regulations that influence the structure of the collaborative, including the University of Minnesota regulations that have to be adhered to in hiring staff, since the University acts as fiscal agent for the collaborative. The corporate world imposes a second institutional perspective on the collaborative, one that is guided by principles of efficiency in decisionmaking. In corporate meeting practice, the ground work is done ahead of time so that during a meeting those present are given the information necessary to weigh the alternatives and choose what is most appropriate. The third perspective is that of the teachers who have autonomy in their classrooms and responsibility for helping students learn while, at the same time, feeling a strong responsibility for offering caring support to students. In performing their work, however, teachers have little control over available funds, the curriculum they are to teach, or how they will spend their time during their working day.

During the year, several events occurred that illuminated the differences in perspective and how they have come to bear on the way in which the collaborative conducts its business. Although the focus is on the collaborative effort in the Twin Cities, the interaction of differing perspectives is true of collaboration in general.

During the summer the Executive Committee of the Governing Board produced a position description for the coordinator's position. This description envisioned the coordinator as performing administrative duties for the collaborative while serving in the Special Projects Office. This 25-percent position would be responsible for arranging the meeting place for events, doing mailings, and taking minutes for the Board's Executive Committee meetings. The pay was commensurate with that of the other office personnel in the Special Projects Office. In fact, this was one of the constraints imposed on the position. For the coordinator to work in the Special Projects Office, which is governed by the rules of the University, the director of that office felt it important that the position conform to the salary guidelines for other administrative assistants or part-time workers in that office.

Some of the Building Representatives teachers envisioned the coordinator more as a teacher leader who would be active in their group, plan professional development activities, and even present some workshops. This person would have to come from a mathematics education background and be employed half time, if not more. The teachers cited the coordinators in Los Angeles and Philadelphia as models.

The person who accepted the position, a part-time mathematics supervisor who was two months from retirement, envisioned the duties as more of an extension of what he had been doing for the district. This conformed to the view the teachers had of the position. He acknowledged the need to handle administrative duties. This had been made very clear to him by the chair of the Governing Board when the coordinator's position was offered. The chair noted that there was a possibility that the coordinator could mold the position into that of a "teacher coordinator," but the most pressing needs at the time were the clerical tasks of coordinating the activities and mailings.

After thinking about the coordinator's role as presented and the differences between what he wanted to do as a leader of teachers and the more restrictive tasks that had to be attended to, the applicant refused the position. Since the University had already approved the personnel action, the administration of the collaborative was concerned that the University would not be receptive to repeating the process. Furthermore, the absence of a coordinator left a void in the collaborative's day-to-day operations.

A second issue during the school year that accented the difference in the perspectives of some of the teachers and the collaborative administration was that of the graphing calculator workshops. In the summer of 1989, Citicorp offered the collaborative funds if it would submit a proposal by a specified deadline. The chair of the Governing Board and the director of the Special Projects Office, with input from the Executive Committee, wrote a grant application for funding a graphing calculator workshop by Frank Demana, a professor in mathematics at Ohio State University. Dr. Demana has a national reputation for his curriculum work involving the graphing calculator, and two teachers who had attended a workshop given by Dr. Demana in the Twin Cities raved about his presentation. The proposal was submitted and the funds were granted for a workshop to be held in July, 1990.

After attending a Woodrow Wilson Summer Institute, a collaborative teacher, however, had developed a plan to do a graphing calculator workshop for other collaborative teachers. While the workshop had the support of the Building Representatives, the Building Representatives had not gone through established procedure for seeking Governing Board approval. It was a case of a teacher taking initiative, supported by other teachers who liked the idea of one of their own giving a workshop. The teacher was stymied by the operating rules for the collaborative. Some of the teachers viewed the rejection as an indication of the lack of power teachers have in the collaborative.

Eventually both workshops were offered. This again demonstrated a clash of values for the teachers who are interested, on the one hand, in attending to their need for professional development and on the other in supporting each other. However, the failure to follow proper procedure, as viewed by the collaborative administrators, amounted to ignoring rules that had been established to advance the collaborative.

A third event, which was aimed at reducing the tension between the Governing Board and the Building Representatives group, took place in March. Two of the business representatives on the Governing Board were invited to meet with the Building Representatives' group to discuss their different perspectives. This was the first Building Representatives meeting attended by anyone from business at which a specific issue was targeted for discussion. Both the teachers and the business people were very open with one another. As a result of the interaction, teachers became more understanding of what was required by the University for approving collaborative initiatives. One teacher remarked, "I understand some things about working under the University bureaucracy that I didn't before." One business representative commented, "I think this went very well. We are closer together and understand each other's viewpoints better." Previous events had aggravated the misunderstandings between teachers and some members of the Governing Board. The collaborative provided a forum at which the two groups could begin to understand each other's perspective.

At the end of the school year, the Mid-Life Review Committee was formed and met once to offer recommendations for adjustments that needed to be made in the course of the collaborative. After two years, a structural framework had been created for administration of the collaborative, but bonding among the different groups had not yet become a reality. Some attempts have been made by teachers, by business, and by University personnel to understand one another better through shared management of the collaborative. But in the effort to collaborate, a conflict continues to exist between a strong, efficiently operated administration and a teacher membership concerned with the development of teacher ownership and participation.

The TCUMC has been able to set priorities that enable it to offer essential activities within a budget that ensures the availability of funds for up to five years. The collaborative has a well-defined governance structure that includes representatives from all sectors, and has generated strong support from those in business and higher education.

In 1989-90, conversations and meetings were held to further understanding among the different groups. Hopefully, the Mid-Life Review Committee can build on this. Unless care is taken to truly involve and value the perspectives of those from the schools, business, and the University, there is the possibility that the review will only sustain the struggle rather than build on the strengths of those on which the collaborative is dependent.

**Collaboration**

As noted by one business representative, the Twin Cities Urban Mathematics Collaborative has provided the seeds for an active, cohesive mathematics community in the Twin Cities. There are committed individuals from business, higher education, the school districts, and private schools who have given time and energy to make the collaborative succeed. Dinner meetings have provided opportunities for members of these different sectors to interact with one another and to hear presentations on mathematics. As noted above, members of each sector serve on the Governing Board and interact in the course of carrying on the business of the collaborative. An important outcome of the collaborative, as pointed out by a person who has been active in its administration, was that after five years those from business, higher education, and teachers continue to sit down together and work with one another.

Business people are motivated to participate for personal reasons and to contribute to solving what is seen as a crisis in mathematics--i.e., the challenge to society of producing citizens whose knowledge of mathematics and science will enable them to perform the jobs of the future. One business person valued dialogue about mathematics issues at the grassroots level. As a result of this process, some trust among the different groups has been generated. Those from higher education are appreciative of the efforts to improve the quality of school mathematics, which is having the effect of increasing the number of students taking mathematics after high school. The districts benefit through TCUMC programs that address professional development for teachers--programs that would be difficult to finance otherwise. Teachers who attended the graphing calculator workshops were given a graphing calculator. One teacher noted that the districts could not afford to do this on their own.

Teachers acknowledge the importance of interaction with those from the other sectors within the collaborative. But the most important form of collaboration they have experienced is with each other. This has come about as a result of their contact at meetings of the Building Representatives, at the dinner meetings, and at other collaborative activities. From getting to know each other better, some of the teachers have taken initiative in collaborating with other teachers on special projects. One example is the development of the junior high school mathematics leagues by collaborative teachers in St. Paul. Junior high school teams now exist in approximately 60 schools in different regions of the state. Another example is provided by the three teachers who attended the Woodrow Wilson Institute in Princeton during the summer of 1989. When they returned, they continued to meet monthly along with two others from the area who had attended the same Institute. As a result of these meetings, the teachers decided to approach the state for funding of regional centers at which mathematics teachers could attend institutes on new ways of teaching algebra.

The process of writing and submitting the proposal for an EDC Outreach Grant was a significant development in collaboration by TCUMC. With the goal of preparing a proposal to EDC, a group of teachers along with two persons from the business sector conceptualized and completed it. The evolution of this project demonstrated the viability of the current structure of the collaborative and the way it can serve to develop true collaboration on the part of teachers in significant interaction with those from other sectors. After hearing about the UMC Outreach Action Grants at the joint Building Representatives and Governing Board meeting in December, the Governing Board Executive Committee agreed that a proposal should be prepared and submitted. A committee of five teachers, one business representative, and the chair of the Governing Board was formed and met two times during winter break. The Building Representatives had met prior to this time and recommended that the grant proposal be directed toward the area of junior high school mathematics. The draft of the proposal was shared with the Governing Board and the Building Representatives group in January, at which time each offered input and suggestions. The Executive Committee of the Governing Board gave final approval to the proposal, which sought funds for identifying appropriate materials emphasizing problem solving, equation solving, and graphing that would prepare junior high school students to take higher-level mathematics courses. This was a constructive experience for the collaborative, although TCUMC members were disappointed that EDC did not fund the proposal. Hopefully, the experience itself will serve as an example to collaborative members of working together on similar projects in the future. What was encouraging was that as soon as EDC's decision was known, members of the collaborative began to think of other funding sources.

One form of collaboration that has been difficult to develop to any significant extent in the Twin Cities is the interaction between the collaborative and the two districts. On the surface, each district has supported the collaborative by granting it a small amount of funding. The two district mathematics supervisors have been active participants on the Governing Board and in other collaborative activities. But the collaborative seems to be viewed as outside the real work of the districts. The collaborative has provided significant professional development opportunities for mathematics teachers in both of the districts. Yet the question remains as to how each district values or acknowledges these experiences, particularly when teachers seek release time to attend a conference or national meeting. The collaborative has attempted to better situate itself by making more overtures to the two districts such as including a member of the St. Paul Board of Education on its Governing Board.

### Professionalism

One result of the collaborative has been an increase in the professional activities of a group of mathematics teachers in the Twin Cities area. These teachers are actively attending conferences and other professional meetings, writing proposals, and giving each other support. Over the course of the collaborative's development, several mathematics teachers in the Twin Cities area have been given special honors such as receiving Presidential Awards, being selected as Woodrow Wilson Master Teachers, and serving on state and district committees. The St. Paul mathematics supervisor acknowledges that because of the number who are involved, the collaborative teachers are very visible in district activities.

One impact of the collaborative has been to foster greater risk taking on the part of some of the mathematics teachers. This again is related to mathematics teachers getting to know each other better and giving each other encouragement in trying new ideas--a phenomenon observed by others who have been active in the collaborative. A business representative suggested that one of the most important benefits of the collaborative was that it gave mathematics teachers a different feel for their job and for other teachers.

Teachers have been encouraged to participate in such experiences as the Woodrow Wilson Institutes. One teacher was so impressed with the leaders and programs of a one-week Summer Institute she attended that she wanted to participate in the four-week Woodrow Wilson Summer Institute program held in Princeton. In 1989, she applied to the collaborative for an Institute grant and was accepted.

Teacher leadership development has been effective for some teachers, but this is an area that not all collaborative participants view in the same way. Teachers see their work with the Building Representatives groups and other teacher-initiated activities as a demonstration of teacher professionalism. But representatives of higher education and business question the level of professionalism of teachers who, for example, feel they lack authority or who are angry because of decisions made according to rules set by the Governing Board. Some collaborative participants have noted the difficulty teachers seem to have in formulating their ideas and being able to communicate them to people in business and higher education. These teachers are seen by some Board members as more interested in focusing on the differences between teachers and those from the other sectors than in recognizing the value of working as colleagues with those in business and higher education.

Another area in which teachers' skills have been questioned involves developing a budget. The collaborative director requested that the Building Representatives develop a budget indicating how the $3,500 for the 1989-90 school year would be spent. This budget was to be submitted to the Governing Board for approval. The teacher who was asked to prepare the budget reported being unsure of how to proceed. This was construed by some members of the Governing Board as a failure of professionalism. Unfortunately, rather than sitting down to assist the teacher in understanding more about building a budget, the members of the Governing Board developed a budget for the teachers. This was a missed opportunity for the transfer of budget writing skills from business representatives, who are familiar with the process, to teachers who are less acquainted with budgeting. One business representative said that he had asked his firm to withhold contributions to the collaborative until teachers came forward with a specific proposal indicating how the money would be spent. This never happened. The firm eventually donated the money. The business representative questioned whether the teachers really had the skills that enabled them to develop ideas and then submit those ideas in a way others would support.

The 102 teachers who returned ballots in the spring 1990 election of collaborative teacher leadership indicated that about a half of the Twin Cities mathematics teachers are interested enough in the collaborative to vote. Those 30 to 40 teachers who serve on the Building Representatives and its Executive Committee form the core of the most active teachers. From within this very active core, both groups have drawn teachers who have demonstrated initiative in developing programs. However, some teachers in the core group as well as others are perceived by certain Governing Board members as having failed to demonstrate the anticipated initiative. This includes devising ideas and soliciting help from others in overcoming barriers.

Some teachers have attributed significant changes to the collaborative. A teacher who has been very active in the collaborative noted how it has developed her leadership qualities, "I was very quiet and taught in a style of teaching much like I was taught. I wasn't aware of all the ideas and changes going on. My classes were becoming more and more difficult to teach because of the problems of urban students. Being able to network, get new ideas, and become involved in the collaborative has literally changed me for the better. I really believe it has made a great difference in my career and can't understand why others don't make time for it."

The Building Representatives' meeting that was attended by two business representatives helped increase understanding across the sectors. The last Governing Board meeting of the school year began with a social hour that provided an opportunity for members to meet each other in a less formal atmosphere than in the actual meeting. The preparation of the Outreach Grant proposal was another activity that helped to further understanding across sectors because people became engaged cooperatively in a professional process.

### Mathematics Focus

The mathematics focus in the Twin Cities continues to be strongly directed by reform and a sophisticated notion of mathematics. This is in part a result of locating the collaborative within the Special Projects Office of the Mathematics Department at the University of Minnesota. Those who have been active in the collaborative during the course of its evolution speak of its success in developing and attracting members of the community based on a shared interest in mathematics. The Twin Cities Mathematics Society, which was started through the collaborative, continued its activities during 1989-90, with members assuming the responsibility for the full cost of the dinners that were an integral part of the Society's program. This has resulted in some decrease in participation, but attendance at the three dinner meetings ranged from around 25 to 60. In order to appeal to a larger group, these dinners featured speakers on mathematics, such as Professor Konhauser's discussion of mathematical problems and the talk of Dr. Hamermesh on symmetry in art and science.

The collaborative once again sponsored a one-week Woodrow Wilson Summer Institute, which in 1990 focused on functions and the use of technology. Three other collaborative activities during the year gave teachers an opportunity to learn more about using graphing calculators. Teachers also were awarded scholarships that enabled them to attend state and national conferences, including the UMC Teacher Leadership Workshop.

It is significant that collaborative members from all sectors served on the governor's 36-member Task Force on Mathematics, Science, Technology, and International Education. The six collaborative members on the Task Force had the opportunity to influence state policy development in mathematics education. This gave the TCUMC teachers a forum for the recognition of innovative programs, as well as an opportunity to extend their influence beyond the two districts to the entire state.

The Outreach proposal submitted to EDC, prepared by the teachers, is indicative of the work of the collaborative and its history. The proposal sought funding to support curriculum development over the summer and the field testing of materials during the year. This was reminiscent of the early stages of the collaborative when teachers participated in summer institutes and then, based on their experience, produced materials that they tried out during the school year and shared with the other participants. Supporting reform in mathematics has been the objective of both the summer institutes and the proposed curriculum development effort. The collaborative has always held that if there is to be real change, the change must occur statewide rather than only locally and involve such basic initiatives as the development of curriculum materials that can be shared with others in the district or state.

The proposal's focus for the summer of 1990, the development of materials for junior high school, also reflects a fundamental change in collaborative thinking and indicates the influence of current recommendations as well as the work of the total UMC enterprise. The main rationale for working with the junior high school curriculum was to provide students with strong mathematics experiences that will prepare them to successfully complete algebra as a basis for taking other high school mathematics. This supported national recommendations to increase the level of mathematics taken by all high students. Equity issues also were addressed in the proposal, which included program components that would provide students with role models of females and other groups who are underrepresented in work areas heavily dependent on a knowledge of mathematics. In a way, the proposal summarized the efforts of the Twin Cities Urban Mathematics Collaborative to draw upon the rich resources in the area to provide teachers with experiences based on sound mathematics that have the potential for addressing equity and mathematics reform and that can be widely distributed within the Twin Cities and to other districts in the state.

## F. Next Steps

TCUMC anticipates that 1990-91 will be a busy and productive year. The Mid-Life Review Committee, which was organized late in the spring of 1990 for the purpose of evaluating the collaborative's progress at the mid-point of its Ford Foundation grant cycle, has scheduled meeting dates for July 17, August 14 and 28, and September 4, 1990. Although the collaborative did not receive an EDC Outreach Grant, a collaborative decision was made to modify the request and submit it to the Minnesota Eisenhower Title II Awards Program for potential additional funds.

James Whitney, who was hired as the collaborative's interim coordinator, ended his temporary appointment on June 30, 1990. TCUMC will conduct a summer recruitment to fill the position. In May, 1990, the Building Representatives focused their attention on the 1990-91 program. The format for future meetings is being changed and coordinators were appointed for the September, October, and November, 1990, meetings. The Executive Committee of the Building Representatives scheduled a meeting for August 30, 1990.

The UMC project has scheduled its annual meeting in the Twin Cities and has asked the TCUMC to act as host. The meeting will be held October 18-20, 1990--the same weekend on which the annual meeting of the Minnesota Education Association is scheduled. Five or six TCUMC members will serve on a local committee to plan the events that the collaborative wants to sponsor during the UMC meeting.

Professional enrichment activities for TCUMC members are plentiful. On July 14, 1990, a collaborative-sponsored workshop, led by Dr. Frank Demana of Ohio State University, will focus on graphing calculators. The workshop will be funded through a grant from Citicorp. The College of St. Catherine, St. Paul, will host a Woodrow Wilson Foundation Institute for Teachers of Secondary Mathematics with an emphasis on geometry, July 9-13, 1990; TCUMC made provision for 16 teacher scholarships. EDC will provide funding for one teacher to attend the EDC Teacher Leadership Workshop from August 4 to 11, 1990, in New Hampshire. Teachers in the St. Paul district have the opportunity to apply for minigrants of from $50 to $450, provided by the school district. Finally, several TCUMC teachers will serve as information coordinators on a summer mathematics tour of the United Kingdom. The tour, which will be held June 30-July 15, 1990, enables mathematics educators to tour the United Kingdom to gather ideas that will help them implement the NCTM *Curriculum and Evaluation Standards*.

Several TCUMC teachers are active in the Minnesota Council of Teachers in Mathematics (MCTM) and will serve as facilitators and presenters at regional meetings. TCUMC members have served on MCTM regional boards in an executive capacity. Two major MCTM conference dates have been scheduled, which will provide TCUMC members with additional enrichment experiences. The Fall Conference is scheduled for October 19, 1990, and the Mathematical Connections Conference is scheduled for April 26-27, 1991.